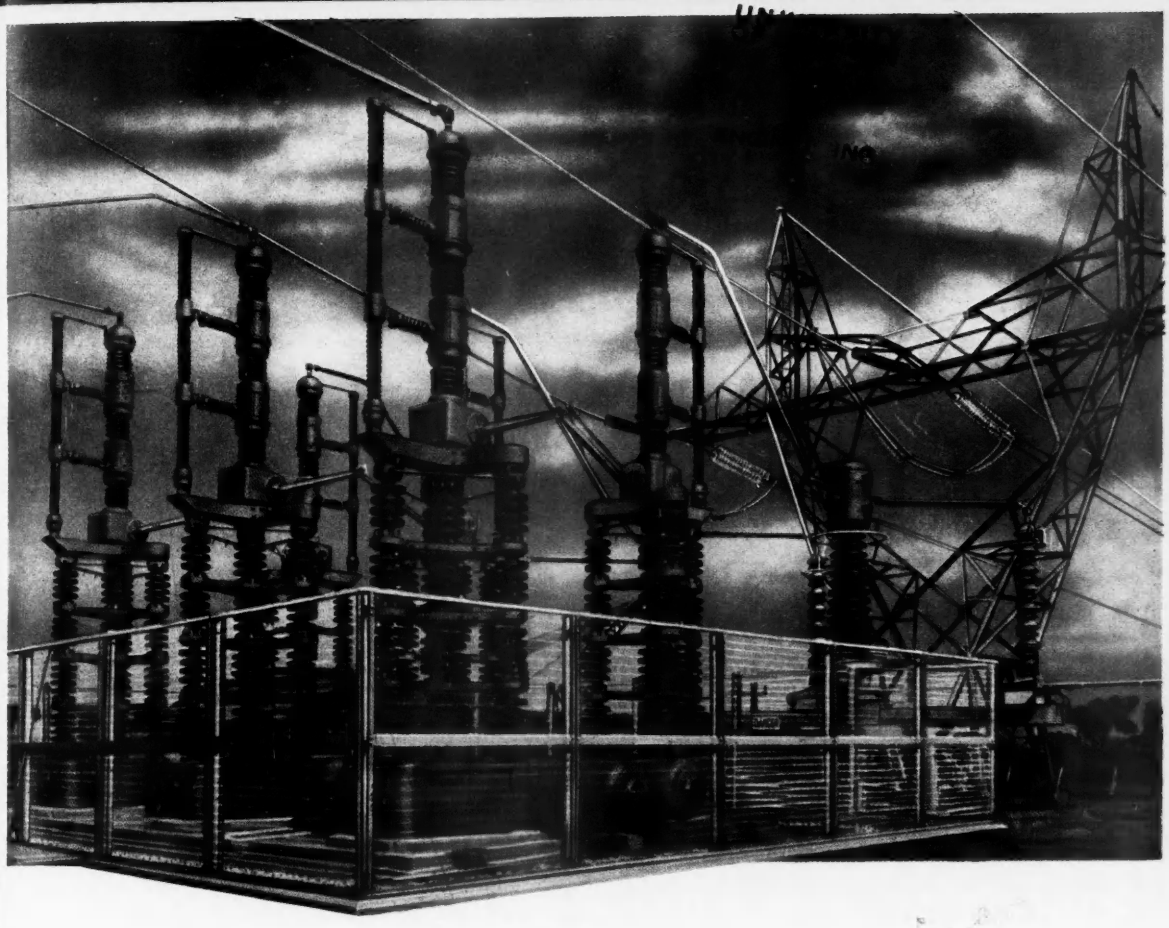
ELECTRICAL REVIEW



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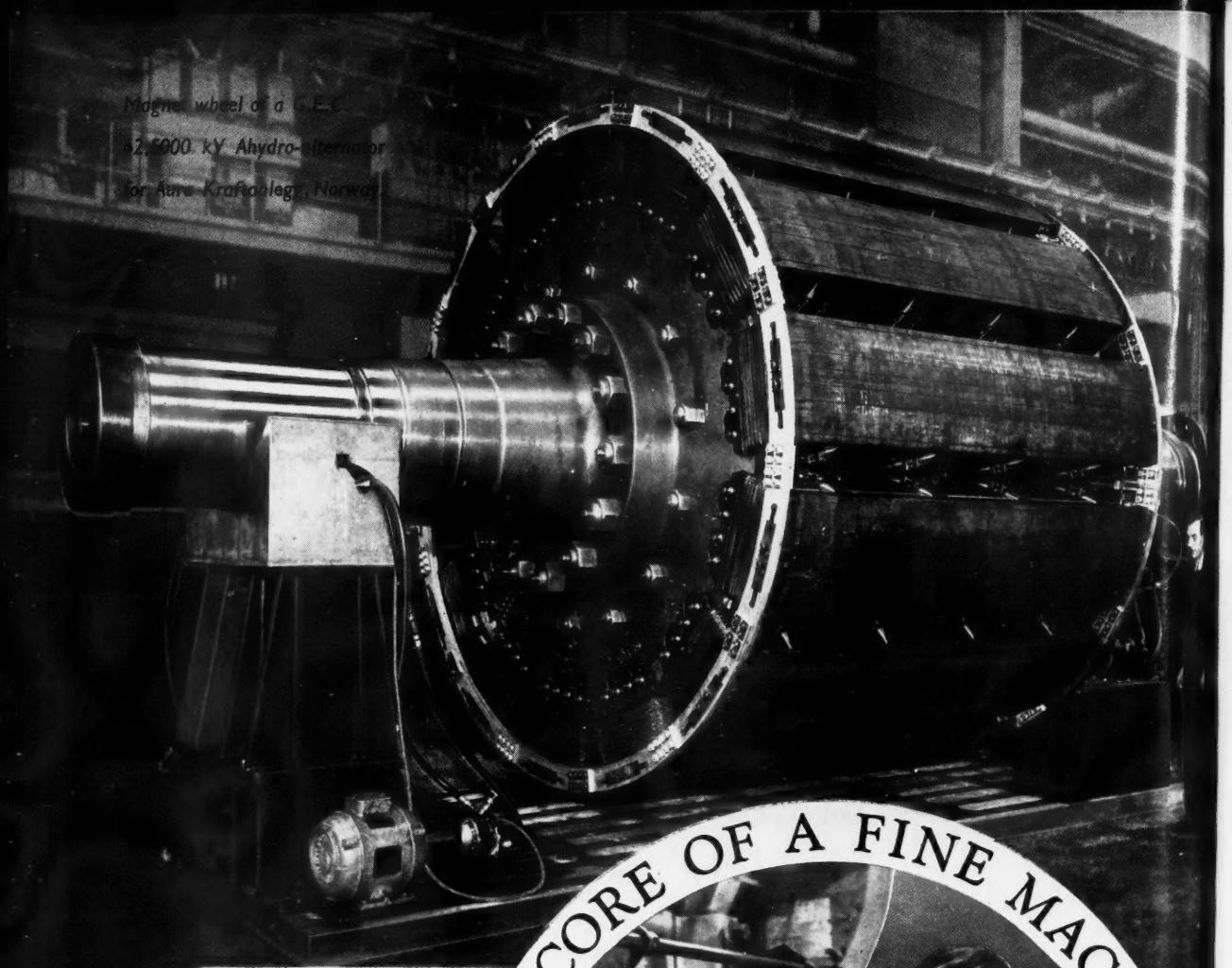


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# ELECTRICAL REVIEW

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11 NOVEMBER 1955

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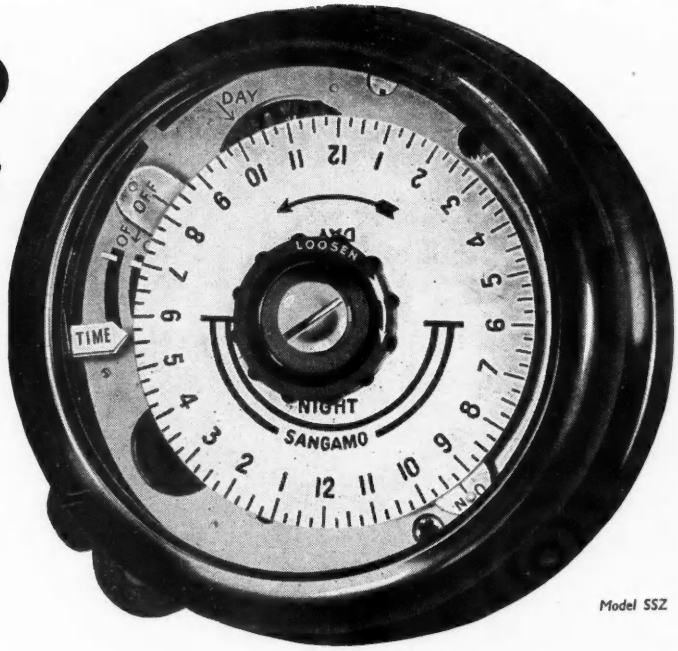


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ELECTRICAL REVIEW

11 November 1955 Vol. 157 No. 20 Established 1872

# Atomic Energy Report

THE first thing which arrests the attention of the reader of the first annual report of the United Kingdom Atomic Energy Authority, which is reviewed in this issue, is the absence of financial statistics which usually take up a large part of annual reports of commercial concerns. A part of the answer to this is that the A.E.A. is not a commercial concern. In view of the influence it must continue to exert increasingly over its sister organization the Central Electricity Authority, however, it is somewhat difficult for the electrical man at any rate to see the A.E.A. as a non-commercial body. The overriding facts are that the Authority is so closely linked with military affairs, with consequent secrecy, and that extremely expensive research is a vital part of its activities.

At the Press conference which was held in connection with the publication of the report last week, Sir Edwin Plowden, chairman of the Authority, stressed how fortunate they had been in having taken over a going concern. This may well be so, but if we consider the vast organization which it was necessary in the first place for the Authority to set up and the important part it has played in the promotion of the Government's nuclear power programme, which was outlined in the *Electrical Review* of 25th February last, we can realize how much has been done in well under a year.

Both from the report and answers to questions put at the conference it seems to be quite clear that there are not likely to be any difficulties over the supply of money and materials. No Government yet, whatever party, has unduly restricted money for atomic energy affairs and a world survey has revealed adequate supplies of radioactive materials so far as the demand can be foreseen.

The supply of technologists is quite a different matter. This difficulty is emphasized more than once in the report and at the conference Sir John Cockcroft implied that although they were running three or four courses a year at the Reactor School at Harwell with 30 or 40 students in each course, they were still in the stage of providing teaching staffs. The seriousness of this position can only be measured properly if we take into consideration the fact that the shortage of technologists in the electrical industry is already acute and that the demands of the newer technology compete with those of the electrical world.

This remains an extremely serious obstacle to the greater progress of the electrical industry, and adequate measures to attract recruits into both the electrical and atomic fields are urgently needed. It is appalling that the development of much needed nuclear energy should be retarded, not by any lack of scientific inventiveness, but because of the inadequate supply of trained men.

## SUPPLIES IN PARALLEL

There is a fairly widespread belief among works electrical engineers that the stability of a works private generation electrical system running in parallel with the public supply is ensured merely by the influence of the characteristics of the larger system which "pulls" those of the local system "into line." No doubt this belief arises out of experiences often met when one of a number of alternators on the same system is "pulled into step" with its sister machine during synchronization operations. In his article "Automatic Exciter Regulation" in this issue, however, Mr. L. R. Girling shows the falsity of this belief, particularly where the exciting machine for the local alternator is used for power factor correction purposes. Indeed, he shows that it is inadvisable to try to hold the voltage constant for a small generator connected with the public supply, although by suitably compounding a voltage regulator with the proportion of the load current the regulator can be made to control the power factor of the alternator output. Thus it is important to bear in mind the author's conclusions that automatic voltage regulation must receive very special attention when designing such a parallel running scheme, for a true voltage regulator can result in serious instability, whereas a correctly designed power factor regulator can help to ensure stability.

## EXPORTS AND THE HOME MARKET

Whether or not the Chancellor of the Exchequer's hopes of diverting more goods into export channels are realized—and the debate on the Budget proposals revealed a considerable difference of opinion on this point—the increases in purchase tax can only serve as a temporary expedient. Already new demands are being made for wage increases to compensate for the higher cost of living and manufacturers must face the prospect of higher wages adding to their difficulties in meeting overseas competition. Mr. Leslie Gamage, president of the Institute of Export and joint managing director of the General Electric Co., Ltd., speaking at Liverpool, said that we must "make priority for exports a reality and not just a talking point." We had to forget the days when what was right for the home market had to be accepted overseas and adopt a new conception that what was right for overseas had got to be accepted in the home market. If we really meant business should we not change over to the metric system as India was doing? How much better would our already excellent radio and television equipment export figures be if the same sets could be sold in both home and export markets?

## "TOUGH" FUTURE

We suppose that conditions experienced by one leading manufacturing concern in overseas markets are common to others. Thus it is of value to have the views on the situation of Sir Claude Gibb, managing director of C. A. Parsons & Co., Ltd. Referring to the extension of the works Sir Claude says in the company's October "News Letter" that when everything appeared to be going "according to plan" there was an increase in Continental competition and export prices fell. At home the economic situation has worsened and things have been made more difficult by "credit squeezes" in some overseas countries which have rendered customers unable to make payments already overdue. Sir Claude expects the future to be "tough"; orders already booked will keep the company going for this year and next but orders booked so far this year have been less than half the rate necessary to keep the works in full production. Orders have been lost to Continental manufacturers through high prices and long delivery periods. The extensions will take care of delivery and lead to slightly reduced costs, but the continued rise of material and labour costs would put the company (and presumably others) out of world markets. Nevertheless Sir Claude says he has complete confidence in the company's ability to face future difficulties and win; he says: "The future will continue to be great so long as we do not price ourselves out of world markets."

## SELLING TO THE U.S.A.

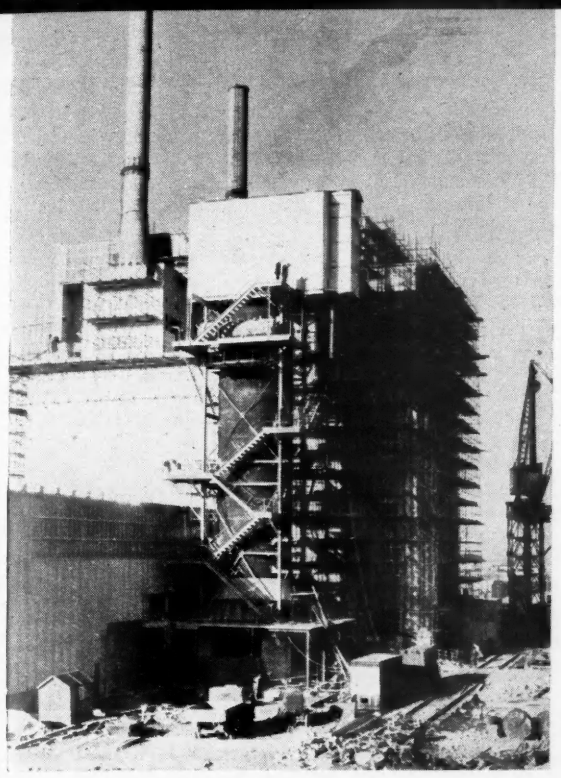
At a Press conference last week executives of the Solartron Electronic Group discussed a recent exploration of the American market for special electronic equipment. Not many of the smaller firms in the industry have been as bold or could be as satisfied with what, in terms of material results, have been minor returns. It has been in the learning of American technique and requirements, both as regards the equipment and the manner of selling it, that the reward has been reaped. Among the points emphasized were the need for forceful advertising in the American style, the use of the customers' terminology on instruction plates, etc., the importance of a first class service manual, backed by a servicing organization in the country, and attention to the slight differences in operating methods such as the reverse positioning of on-off switches compared with practice in this country. More than 60 per cent of the world's market for electronic equipment lies in the United States and the only way to gain a share is to go to the customer's works and demonstrate on his doorstep.

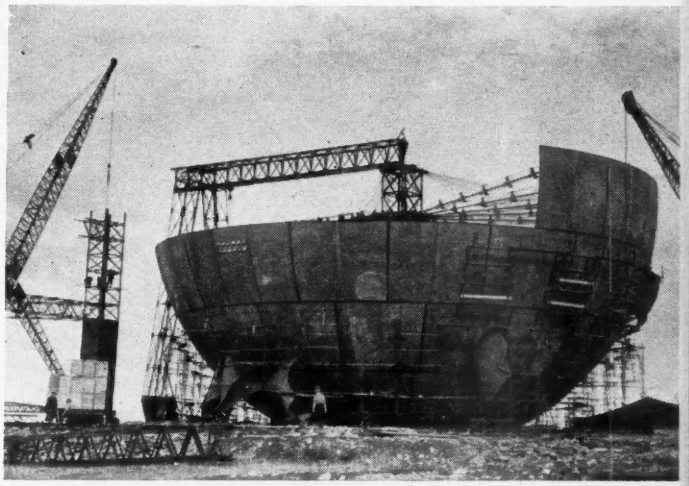
## INDUSTRY AND EDUCATION

Support for scientific education by industry takes a number of forms and the leading electrical concerns give much practical assistance to national and local educational institutions. Generally the schools thus aided are provided with public funds by which they are enabled to provide the necessary buildings or extensions for their science departments. To assist those schools which are not so favoured a number of companies (including four of the principal electrical groups), whose names were given in our last issue, have guaranteed a fund of over £1½ million for the provision of capital grants towards the building, modernizing and equipping of science buildings by these independent schools. No doubt other electrical concerns would like to take part in this endeavour to meet the increasing demand from industry for scientifically trained men and women. The offices of the Industrial Fund for the Advancement of Scientific Education in Schools are at 20, Savile Row, London, W.1, and the secretary is Mr. P. Ashton.

# Atomic Energy Affairs

## FIRST ANNUAL REPORT OF THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY





*Recent photographs depicting state of construction of Calder Hall (above) and Dounreay (right) power stations*

THE first annual report of the United Kingdom Atomic Energy Authority was presented to Parliament last week and coinciding with the presentation a Press conference was held at the Board of Trade, at which Sir Edwin Plowden, K.C.B., K.B.E., chairman of the Authority, presided, supported by senior members of the executive staff. In his opening address Sir Edwin said that the report covered the period from vesting day, 19th July, 1954, to 31st March last. Each future report would cover the full financial year. This report was rather more comprehensive than subsequent ones would be in that it not only outlined the framework of the Atomic Energy Authority but it also gave a fairly full description of the basic processes and the work of the establishments.

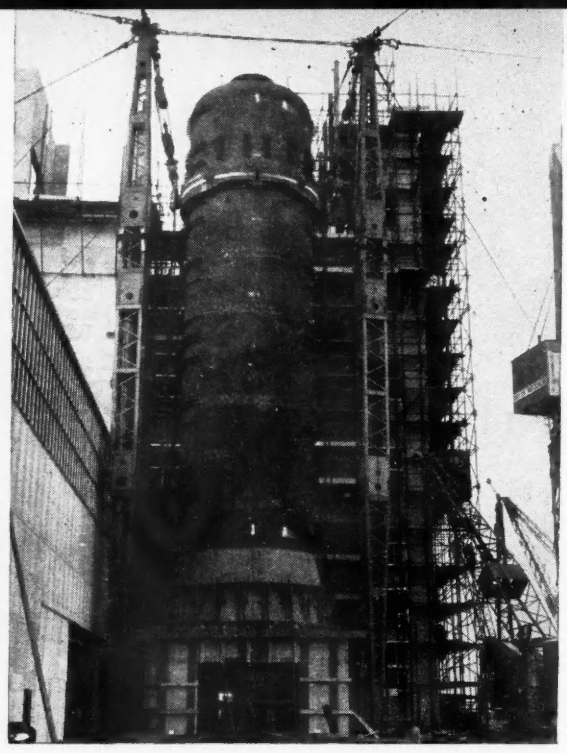
The A.E.A. had two functions, military and civil. The military side of its function was dealt with in one short paragraph, for obvious reasons. The Authority took over a going concern, but much work had to be done to set up a self-contained organization under the ægis of the Ministry of Supply. The Government's decision to launch a full-scale nuclear power programme was announced in February. There had been enormous expansion in the scale of activities. Contact and collaboration with industry had grown over this period, particularly in relation to the civil programme. Sir Edwin mentioned the Geneva Atomic Conference and the enormous increase in public interest in atomic energy.

The report itself shows that the Authority came into being in July, 1954, under the provisions of the Atomic Energy Authority Act which provided that the Authority should consist of a chairman and not fewer than seven nor more than ten other members, all of whom are to be appointed by the Lord President of the Council. With the chairman, Sir Edwin Plowden, K.C.B., K.B.E., there are at present seven members as follows:—Sir John Cockcroft, K.C.B., C.B.E., F.R.S. (member for scientific research); Sir Christopher Hinton, F.R.S. (member for engineering and production); Sir William Penney, K.B.E., F.R.S. (member for weapons research and development); Sir Donald Perrott, K.B.E. (member for finance and administration); Lord Cherwell, C.H., F.R.S.; Sir Luke Fawcett, O.B.E.; and Sir Ivan Stedeford, K.B.E. The last three are part-time members. The secretary of the Authority is Mr. D. E. H. Peirson.

Since the beginning of Britain's post-war atomic energy project the work has been divided among three principal groups: research, production, and weapon development, and under the Authority this form of organization continues. The Authority differs from other nationalized undertakings in that it depends for its funds upon money voted by Parliament.

### Raw Materials

The task of procuring uranium ores and concentrates, as well as of some other important minerals such as thorium and beryllium, is carried out by the Metals Branch of the London Office which works in close collaboration with the Industrial and Research Groups. Because the large demand for these metals has developed only in the last decade this work involves more than the negotiation of contracts with the overseas suppliers. It is also necessary to keep in touch with developments in uranium mining all over the world and to be able to assess the merits of new prospects and offer technical and, on occasion, financial assistance. Accordingly, the Metals Branch has available to it, apart from its own specialist staff, the advice and help of a number of organizations such as the Atomic Energy Division of the Geological Survey and Museum; the Radio-Chemical Group of the Chemical Research



*Heat exchanger in position at Calder Hall*

Laboratory; and the Chemistry, Chemical Engineering and Electronics Divisions, A.E.R.E.

During the last few years a world-wide search for new deposits of uranium has begun, and much effort is being put into the study of improved methods of extraction. It is now realized that while minerals bearing small quantities of uranium are fairly plentiful, the low metallic content and the difficulties of treatment still rule out most of them as economic sources.

When the uranium arrives in this country as an ore or concentrate it is sent to the Springfields factory of the Industrial Group whose operations carried out to produce uranium metal can be divided broadly into three stages. First there is an ore-crushing and multiple purification process leading to ammonium diuranate. Then the diuranate is converted to uranium tetrafluoride in the "Dryway" plant. Finally, the tetrafluoride is reduced to metal billets by mixing it with calcium and firing it in a mould. When the metal billets have been formed in the mould the next stage is to convert them into cartridges for use as fuel elements in a pile, and to do this the billets are formed into rods which are machined to size, put into metal cans and sealed.

In addition to the production of cartridges, Springfields manufactures uranium hexafluoride for the diffusion plants and reconverts it after it has been processed at Capenhurst. The starting point for the manufacture of hexafluoride is uranium tetrafluoride, which is fluorinated to produce the desired gas.

There are three known fissile isotopes, uranium 233 and 235, and plutonium 239. Of these only uranium 235 occurs naturally, the others being produced by the action of neutrons on thorium 232 and uranium 238, respectively, when they are irradiated in reactors. Natural uranium contains only 0·7 per cent of the 235 isotope and to obtain this fissile material in concentrated form it has to be separated from the remainder, which consists of the 238 isotope. This is extremely difficult since they are chemically identical. The method used is diffusion through a porous membrane, which makes use of the different rates of diffusion of the two isotopes due to their different masses. For this a gaseous compound of uranium is needed and the only suitable one is uranium hexafluoride. The diffusion process is carried out at Capenhurst Works, near Chester.

Natural water contains about 0·015 per cent of "heavy water," and it has been known for a long time that distillation can be used to separate the "light" and "heavy" water. The problem, therefore, is not the acquisition of the raw material, nor the method of its separation, but its processing on a commercial scale. For this large quantities of heat are required and heavy capital expenditure is necessary.

## Prototype Power Station

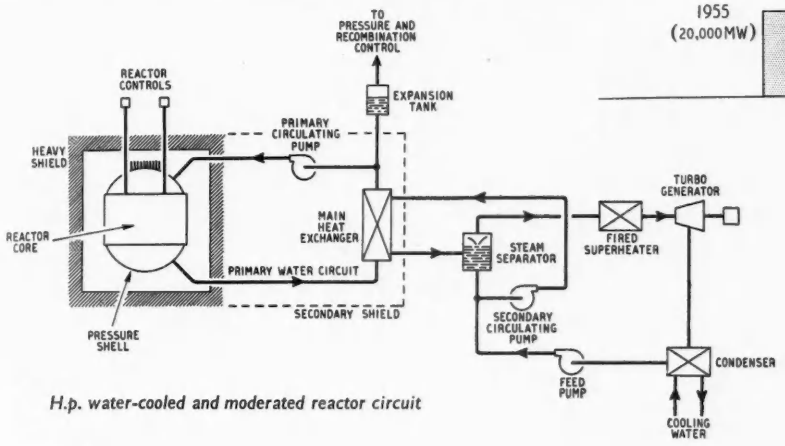
One of the major items in the Authority's capital expenditure has been the continued construction of the prototype power station and factory at Calder Hall. As originally planned, this factory will have two reactors, the heat from which will be used to produce steam to drive turbo-alternators. The generated electricity will then be fed into the Central Electricity Authority's transmission system. The reactors, which are graphite-moderated and cooled by carbon dioxide under pressure, will also produce plutonium for military purposes.

Each reactor is contained in a pressure shell of mild steel about 40ft in diameter and 60ft high, and this pressure vessel is housed in a concrete "biological" shield several feet thick with a heat exchanger at each corner. Between the two reactor buildings is the turbine hall containing conventional turbo-alternator sets and their ancillary equipment.

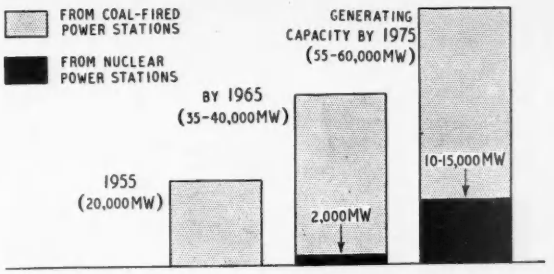
To enable the same construction equipment, such as lifting tackle, to be used for both reactors, and to avoid too great a load on manufacturing capacity, construction of one reactor was programmed to proceed slightly in advance of the other. By the end of the period under

*The A.E.A. executive body (left to right): Mr. F. C. How (Lord President's Office), Sir Christopher Hinton (member for engineering and production), Sir John Cockcroft (member for scientific research), Sir Edwin Plowden (chairman), Mr. E. Underwood (director, public relations), Sir Donald Perrott (member for finance and administration), Mr. W. Strath (member) and Mr. D. E. H. Peirson (secretary)*

review one pressure vessel had been completed, stress-relieved, and tested. The massive concrete housing had been finished and three of the four heat exchangers had been put in position. These exchangers are delivered to the site in sections and then welded together before being lifted into position on their "stools." The pressure vessels, being larger still, arrive on the site as plates which are then welded into four sections—a bottom dome, two rings and a top dome. These sections are then lifted into the reactor house and finally welded together inside. Despite this piecemeal assembly, it is sometimes necessary to raise sections weighing up to 100 tons over 100ft.




*H.p. water-cooled and moderated reactor circuit*




*Relationship between nuclear energy and other power stations*

The turbine hall had nearly been completed at 31st March last, and the installation of equipment had begun. The first cooling tower had reached a height of 126ft. The Authority expects that by 1957 it will be supplying electricity from Calder Hall to the Central Electricity Authority.

## "Breeder" Reactor Station

The Dounreay establishment is intended to house several reactors of experimental or advanced types, and the plants for fabricating their fuel elements and treating them after irradiation. The first commitment there—the construction of a fast "breeder" reactor—had begun by the end of March. This reactor will use highly enriched fuel, either uranium 235 or plutonium; there is no moderator and therefore the core is very small. In order to remove the heat from this small volume it is necessary to use a liquid metal as coolant. Surrounding the core is a "breeder blanket" which will consist of cartridges containing either uranium 238 or thorium, and the spare neutrons from the reaction in the core will convert the "fertile" materials in this blanket into fissile material—plutonium, in the case of uranium 238, or uranium 233 in the case of thorium. In this way it is expected that more fissile material will be produced than is consumed in the reactor.

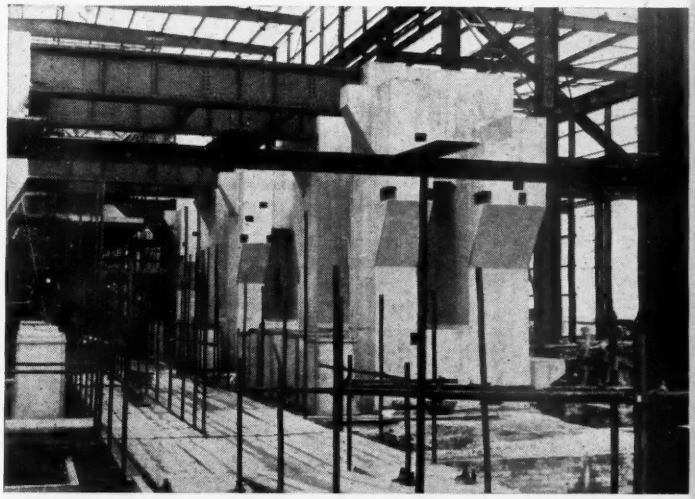
Owing to the small core size, there is a risk that an accident in the reactor might lead to a rapid rise in temperature which in turn might cause the melting of the fuel elements. If this should happen there might be an escape of fission products from the core. To prevent these from being dispersed outside the reactor, it will be enclosed in a steel sphere about 140ft in diameter. The foundations for this sphere were being laid at the end of the period under review when fabrication of the sections for the shell itself had also started.

The rapid advance in technique and the experience gained in designing the Calder Hall station made it possible to consider a programme for the commercial production of electricity from nuclear energy. To this end studies were made in conjunction with the Government Departments concerned and with the Central Electricity Authority, on the basis of which the Government prepared a provisional programme of nuclear power. The programme was set out in a White Paper (Cmd. 9389, "A Programme of Nuclear Power") which was dealt with in the *Electrical Review* of 25th February, 1955.

## Electricity Generation

Although the Authority's general function covers the whole field of atomic energy, there is a specific limitation set in the matter of nuclear power. The Lord President issued a direction to the Authority that the production of power from nuclear energy on a commercial basis was to be carried out by the electricity authorities. The stations proposed will be built by private industry for these authorities who will own and operate them. The Atomic Energy Authority's part in the programme will be the responsibility for giving technical advice on the nuclear plant. It will also give considerable help in the training of the staff of industrial firms and consulting engineers. This work began during the period under review.

*Turbine house under construction at Calder Hall*



Various industrial firms have been given some opportunity of acquiring valuable experience in the nuclear power field through the design and construction contracts for the Calder Hall reactors and for research reactors. Other firms have been given contracts for design studies of even more advanced types of experimental reactor. Industry will be used to the fullest practical extent as further experimental projects mature.

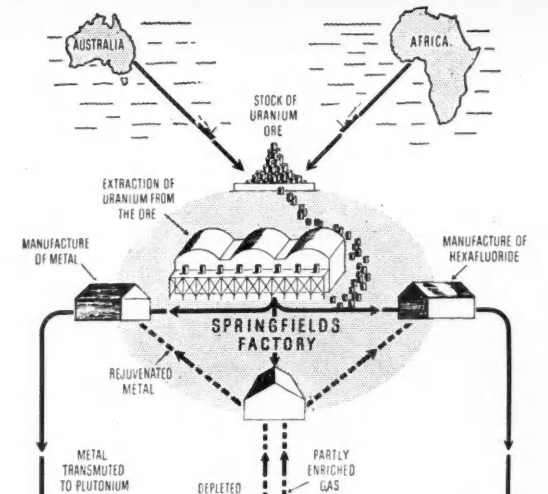
The power programme is backed by a collaboration scheme with the Central Electricity Authority and with industry. A substantial number of engineers from the staffs of the Central Electricity Authority, of consulting engineers, and of several heavy electrical plant manufacturers, boiler makers and other firms are engaged in this scheme and on the design of improved versions of the Calder Hall reactors. The industrial firms concerned have been formed into four teams each led by one of the heavy electrical plant manufacturers, namely: Associated Electrical Industries, Ltd., General Electric Co., Ltd., the English Electric Co., Ltd., and C. A. Parsons & Co., Ltd.

## Staff Problem

The Authority is in competition with industry (and notably with sections of industry that are themselves building up staff in order to enter the field of nuclear energy) for staff to carry out their development programmes and, as a body dependent upon public funds, the Authority has not the same freedom of manœuvre as industry in the matter of salaries. It is aware, of course, that the shortage of technological skill is nation-wide, and that steps are being taken to alleviate it. It feels it essential, however, to put this subject in the forefront of the report because the development of atomic energy is unique in the variety of specialized skills.

The staff which the Authority took over on 1st August, 1954, was materially below the required level for the programmes then in hand. Since that date the programmes, both military and civil, have been enlarged, with a consequent increase in labour requirement; and to normal wastage has been added the exceptional wastage already referred to. Moreover, most of the Authority's establishments are in comparatively isolated areas and the labour resources of the surrounding localities have long since been exhausted.

Most of the establishments of the Authority are large and are in comparatively undeveloped rural areas. A considerable proportion of the staff—indeed most of the skilled staff—have been recruited from other areas where they were accustomed to urban amenities. The influx of so many people in a relatively short time has aggravated the problems of the local authorities. Both the Ministry of Supply in the past and the Authority to-day have therefore accepted a large share of the responsibility for providing housing and other services. If they had not done so the atomic energy project could not have developed as rapidly as it has.




*The overall production flow line for atomic energy*

When asked why our atomic energy programme was on so much smaller a scale than that of Russia or the United States, Sir Edwin Plowden said that it really related to the difference in size and wealth of the countries and the effort which we were able to deploy upon it. He had previously said that the Government of the day, of whatever party, had never spared money for the A.E.A.

Concerning the cost of generation of electricity by nuclear energy, Sir Christopher Hinton said that two-thirds of the power station cost to-day was for fuel and one-third for capital, but the proportion was reversed for nuclear energy. With time the capital cost would definitely go down, and in addition, the running cost was felt to be a little more economical than at the time of the publication of the White Paper.

*Sir Edwin Plowden (extreme left), Sir John Cockcroft (centre) and Sir Christopher Hinton all endeavour to satisfy the keen quest for information at the Press Conference*

# Automatic Exciter Regulation

*Problems Arising out of Parallel Running with Public Supply*

By L. R. GIRLING, A.M.I.E.E.*

THERE are many industrial concerns that utilize small turbine-driven a.c. generators to supplement the power they import from the public supply system and to improve the local load power factor. In the majority of cases these turbines use process steam, and thus the generated power varies with the steam demand. If the generator is used for power factor correction then the exciter field rheostat must be constantly attended if the excitation system is manually controlled. Such a generator of relatively small capacity has a very limited influence upon the busbar voltage when running in parallel with the public supply system, but any change in the voltage level on the incoming feeder will affect the operating conditions of the local generator.

If the field magnetizing current of the generator is adjusted manually by means of the exciter field rheostat and set to, say, the value corresponding to normal voltage on full load, the power factor will depend largely on the kW loading on the generator and to a lesser degree on the busbar voltage.

Fig. 1 (a) is the vector diagram of a cylindrical rotor a.c. generator, the stator winding resistance and saturation being neglected. This diagram shows that with the machine operating at a constant kW loading $W = \sqrt{3}VI \cos \phi$ and a constant internal voltage *Ei* produced by the fixed setting of magnetizing current $i_m$, the operating point is at X. The vector OA is proportional to the voltage on the incoming feeder and the generator terminals and is dependent upon the public supply system. If this voltage should increase by say 5 per cent the product $I \cos \phi$ must decrease to maintain the kW loading constant, and the operating point would take up a position approximately at Y. The converse would occur with a drop in system voltage, the operating point then moving to Z.

It will be seen that these power factor changes due to varying terminal voltage are relatively small, a practical figure being a change in power factor angle of 6 deg for a 5 per cent change in terminal voltage, but consideration must be given to the case where, with nominal terminal voltage and fixed excitation, the kW load is varying. The operating point must remain on the "constant $i_m$" circumference, and therefore with a reduction in kW loading, the operating point will travel along this circumference in a clockwise direction until the synchronous impedance voltage drop and hence $I \cos \phi$ is of the requisite value to restore equilibrium. A case where the kW loading falls from 100 per cent to 50 per cent with the excitation set to give 0·8 power factor at 100 per cent load is illustrated by Fig. 1 (b).

It will be seen that an a.c. generator could be run in parallel with the public supply system with its excitation level manually set to give, say, 0·8 power factor lagging at approximately three-quarters full load, so that at full load the machine would operate nearer to unity power factor. Conversely, at lower loads the power factor would be less than 0·8 p.f. lagging. For any particular machine such an excitation and power factor setting may be obtained experimentally from the generator in service or by calculation from its characteristics. If, however, the generator is under the control of an automatic voltage regulator, the problem becomes more serious. A rise in system voltage would cause the automatic voltage regulator to attempt to lower the voltage by reducing the excitation, but, as the voltage is set by the public supply system, the reduction in excitation would cause the generator to take a leading power factor. The reduction in excitation caused by this regulator action may be large enough to bring the generator out of synchronism; in the case of a small increase in system voltage, however, the increase of stator current due to the leading power factor may cause sufficient voltage drop in the interconnecting cables to balance the regulator before the pull-out point is reached.

Thus it is inadvisable to try and hold the voltage constant automatically for a small generator interconnected

* Mr. Girling is with the Metropolitan-Vickers Electrical Co., Ltd.

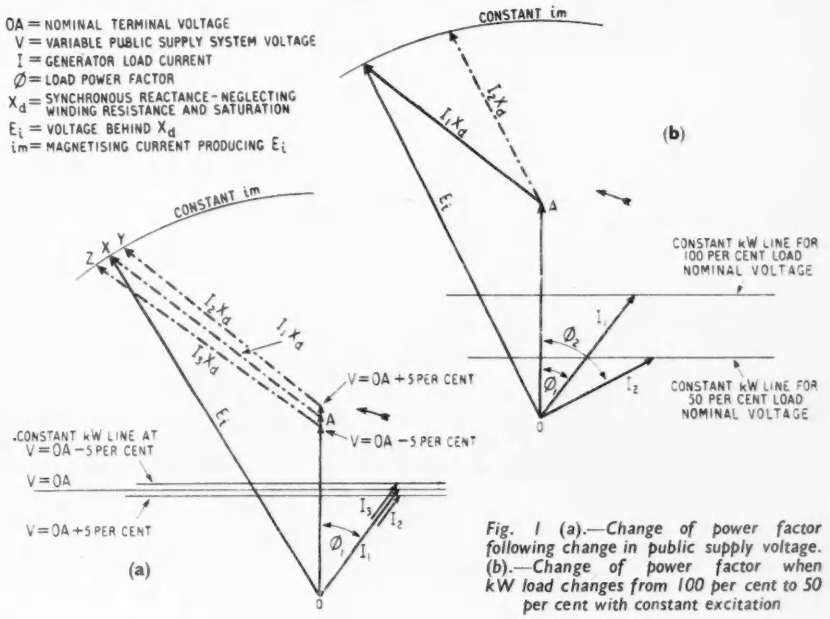



*Fig. 1 (a).—Change of power factor following change in public supply voltage. (b).—Change of power factor when kW load changes from 100 per cent to 50 per cent with constant excitation*

to a large supply system. However, by suitably compounding a regulator with a proportion of load current the regulator can be made to control the power factor of the generator output.

## Methods of Maintaining Stability

The are various methods of maintaining stability when operating in parallel with the public supply system, and a few of the more practical schemes are described below.

(i) Possibly the simplest method is that mentioned previously where the excitation is set manually to some value based on consideration of load and voltage variation together with the machine characteristics. While only a compromise, this scheme has been found acceptable where steam demand is fairly steady during normal hours, the excitation system having to be attended only during shift changes, lunch hours, and the like. The main disadvantage of this scheme of control is evident if the tie between the local generator and the public supply system fails because of a fault, overload trip or similar occurrence. If the generator has been set with less than full load excitation and full load is imposed on it (owing to local loading conditions) the voltage at the terminals would fall; conversely, if the load remaining on the generator was quite low, then a serious overvoltage would result.

(ii) The above scheme can be extended by fitting the generator with an automatic voltage regulator and, when running in parallel with the public supply system, setting the control level of the voltage regulator higher than the maximum voltage experienced on the supply system. Hence, under these circumstances the automatic voltage regulator would always give a maximum excitation condition, this value being set by a permanent step resistance in the exciter field circuit. If the interconnection to the public supply is interrupted, the generator terminal voltage will rise slightly to the setting of the automatic voltage regulator and will then be controlled at this value whatever the local loading conditions may be.

(iii) Possibly the best method of control is to arrange the regulator so that it operates as either a true voltage regulator when the generator is running independently or as a power factor regulator when the generator is running in parallel with the supply system.

## Power Factor Control

Power factor control is achieved by injecting components of generator current, of appropriate magnitude and phase, into the control coil circuit of a standard voltage regulator.

The following methods are usually employed in conjunction with Metropolitan-Vickers automatic voltage regulators types VP, VPA, VC and VCA. All these regulators are of the normally active pattern, the first two being of a carbon-pile rheostatic type, and the others of the vibrating contact type. The approximate limits of control with a system voltage variation of $\pm 5$ per cent are that at full load the power factor will vary by $\pm 5$ deg from the nominal controlled value, and at half full load the variation will be in the region of $\pm 10$ deg. The accuracy of power factor control falls off below half load as the current compounding component becomes relatively small when compared with the voltage component.

The method of connection illustrated in Fig. 2 is used in conjunction with the type VP carbon-pile voltage regulator. If the power factor is required to be readily adjustable the potentiometer resistances between the system voltages and neutral may be of the twin-ganged sliding type or of the fixed type with a twin-ganged selector switch.

Fig. 3 illustrates the method of connection used to compound a type VPA carbon-pile regulator to operate as a power factor regulator. The range of power factor control obtained by adjustment of the power factor control rheostat is then approximately 0·8 lag to 0·8 lead at full load with nominal voltage. The use of current injection across resistance alone is adopted as it is impracticable to inject current into the rather high impedance moving coil.

With the types VC and VCA vibrating contact pattern regulators the circuits may be arranged as shown in Fig. 4

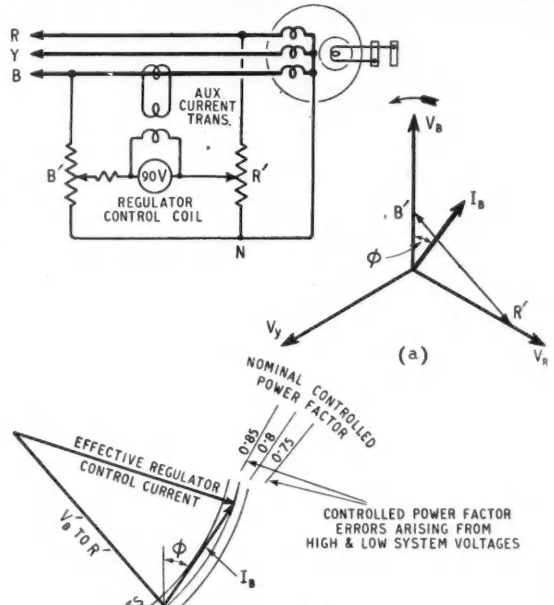



*Fig. 2.—Method of current compounding used on type VP rheostatic regulator; a and b, vector diagrams illustrating voltage and current relationship in regulator control coil circuit*

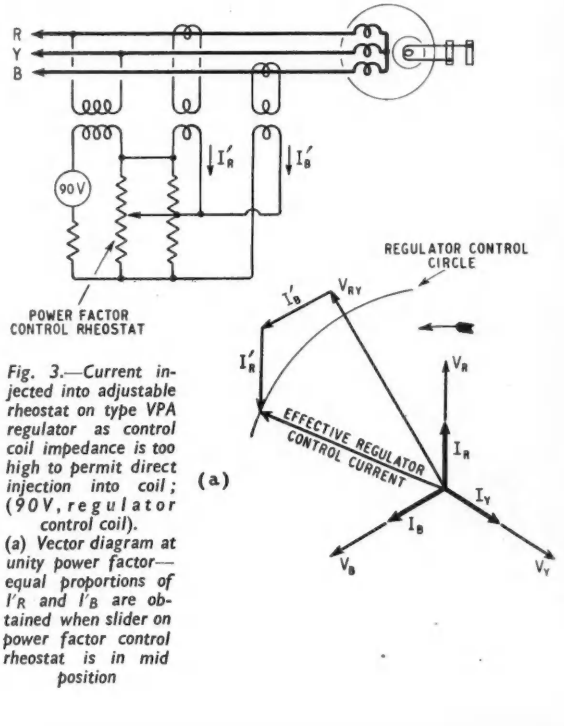



*Fig. 3.—Current injected into adjustable rheostat on type VPA regulator as control coil impedance is too high to permit direct injection into coil; (90V, regulator control coil).*
*(a) Vector diagram at unity power factor—equal proportions of $I'_R$ and $I'_B$ are obtained when slider on power factor control rheostat is in mid position*

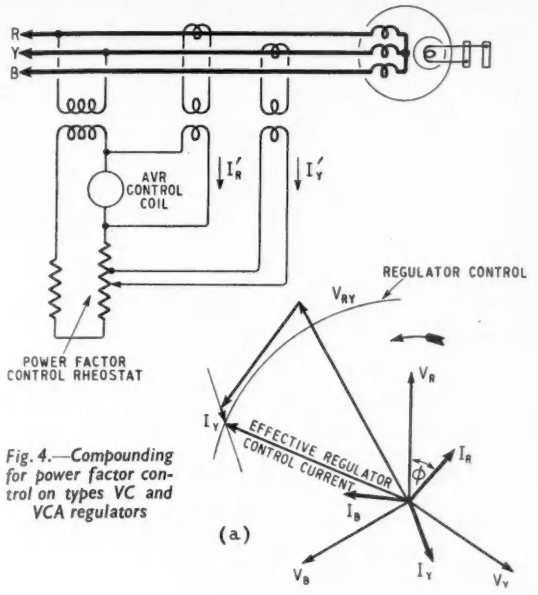



*Fig. 4.—Compounding for power factor control on types VC and VCA regulators*

to give power factor control. By suitable rearrangement of the current transformers each of these schemes can be adopted to control the power factor of synchronous motors and condensers. It can also be arranged to include a p.f.-voltage selector switch connected so as to switch in a compounding current that allows the voltage regulators to control local machines running in parallel when on voltage control. When the machines are running in parallel with the public supply system and are on power factor control, parallel running compensation is inherent in the power factor control compounding.

The burden imposed upon the current transformers by the compounding circuits is in the order of 40 VA per transformer. As, however, the ratio error is not critical and the phase error unimportant (loading is practically constant, and any phase error is taken up on the power factor adjustment), the rating is immaterial. Obviously separate current transformers for power factor control compounding are preferable.

It will be seen that when a small machine is run in parallel with a large system the question of automatic regulation must be carefully examined. A true voltage regulator can give rise to serious instability, whereas a correctly designed power factor regulator can offer an important contribution to overall efficiency.

# Distribution Substations

AS the subject of his chairman's address to the Southern Centre of the Institution of Electrical Engineers, Mr. L. H. Fuller took "Some Aspects of Distribution Substation Design" at voltages below 132 kV. He first referred to the relevant regulations, viz.: the Electricity Regulations introduced in 1908, numbered 1, 14, 17, 21, 25 and 30 and the notes by Mr. H. W. Swann in the 1951 edition; and the Electricity Supply Regulations, 1937, numbered 9, 10, 14 and 16. A third document, B.S. 162 of 1938, now under revision, was particularly suitable for 33 kV outdoor substation design. In all these documents, dimensions were the minimum but were often interpreted as the maximum, leaving no margin for inaccuracies during construction. Two other basic factors were the degree of continuity of supply and safety to life and property.

The following recommendations were submitted for consideration:—Gear for different voltages should be segregated; this included the bus sections of other than small switchboards. Cables for different voltages and those for main input and distribution should be run separately. Substation doors should open outwards and not have raised thresholds, and those for exit should have push-bars. Pebble-filled oil sumps should not project in front of switchgear. With indoor switchgear, up to and including that for 33 kV, there was no need to provide an overhead crane or an outside beam or gantry.

Inadequate ventilation of transformer chambers contributed to acidity of oil at high load factors; often the outlet vent was straight over the inlet without an intervening horizontal baffle, resulting in a hot spot at the back. With through ventilation of switchgear chambers by air bricks, humidity was a better criterion for switching on heaters than temperature, since dampness and not cold caused insulation failure; cold inlets should be away from switchgear.

To eliminate unnecessary civil engineering costs, high ceilings were to be avoided, subject to the regulation 7ft minimum. Roofs should preferably be of concrete, precast beams showing economies over the pitched type. For small buildings 9in bricks or 11in cavity walls were adequate. Large transformer bays should have 13½in walls with 18in buttresses.

For bringing cables into a building, cable trenches and basements were expensive and did not readily give segregation of the cables. Separate cable pipes or individual cable slots taken by the shortest routes were most desirable. Where trenches were necessary, concrete covers lightly grouted-in furnished good protection. Cables in air in a substation should have their serving removed and should be fire-proofed.

The greatest non-productive cost of an ordinary distribution substation was that of the civil engineering works—the smallest building seemed to cost £500 to £600. The greatest practical advance recently was the more extensive use of the completely outdoor 11 kV substation. A typical design shown catered for a 500 kVA transformer with fuse protection, the only real disadvantage being the limitations due to the lack of a h.v. circuit-breaker.

Transformer noise was not easily predictable. An example was cited of a 33 kV unit with a flux density well under 12,000 gauss which was much noisier than one nearby operating at 13,500 gauss, completely unenclosed.

Developments within the next ten years would probably include a more extensive use of the following: Cold-rolled steel in transformers, giving higher efficiency and reduction in size; silicone-insulated transformers in buildings in congested areas; solid or semi-solid connection of transformers without fuses or circuit-breakers; 33 kV as a distribution voltage with simplified feeder isolation gear and fuses or nothing for transformer protection; simpler mounting arrangements for 33 kV switchgear with reduction of control equipment; miniature control boards with telephone pattern relays and simplified cabling at major 66 and 33 kV substations, resulting in considerable savings in building and cable costs; air- or oil-break 33 kV switches capable of dealing with load currents and closing on to faults, permitting a reduction in number of breakers, both indoor and outdoor; integral substations each comprising an 11 kV transformer with h.v. and m.v. fuse gear incorporated in the tank as national standards.

# Radio Investigations

## *Recent Transmission Studies*

FIVE papers were presented before the Radio Section of the Institution of Electrical Engineers on 31st October. Two by Mr. E. D. R. Shearman (D.S.I.R. Radio Research Station) related to ionospheric propagation and ground back-scatter. The theoretical study described showed that measurements of skip distance from the time delay of echoes scattered from the earth's surface gave reasonably accurate results, especially at over 1,000 km, but did not yield unique values of layer height and critical frequency. The earth's magnetic field introduced no ambiguities. Irregularities on land and sea and not the E region were indicated as predominant sources of echoes.

The influence of the aerial polar diagram on the accuracy of skip-distance measurements was considered in the analysis of some further experimental results obtained with a high-power transmitter and various directional aerials which were described in the companion paper. The interpretations of the echo patterns were straightforward in the winter but became complex in summer, when energy propagated by way of several ionic layers returned to the receiver at nearly the same time, showing a marked seasonal increase in E's ionization.

To obtain information about propagation over greater distances than the 1,300 km to which the experiments in the earlier paper were restricted, and to achieve a better signal/noise ratio, the transmitter used had a peak-pulse power of 150 kW and a pulse strength of 120 microseconds to cover a frequency band of 10 to 27 Mc/s.

The subject of a third paper by Mr. R. W. Meadows (Radio Research Station) was an experiment to test the reciprocal radio transmission conditions over an ionospheric path of 740 km. Two-way polar transmissions made simultaneously at 5·1 Mc/s between Slough and Inverness showed that non-reciprocal fading of corresponding echoes occurred for about 1 per cent of an observation period of 15 daylight hours spread over 13 days in May, 1954, indicating that the average path attenuation would not be significantly different in the two directions.

Results obtained over long distances, i.e. across the North Atlantic and between Australia and the United Kingdom, described by Messrs. F. J. M. Laver and H. Stanesby (Post Office), showed that differences in transmission loss up to 10 dB occurred frequently during periods of a few hours or days, being greater for traffic from the U.K. More experimental and theoretical study would be necessary to show whether this tendency was permanent.

Propagation of v.h.f. radio waves by scattering from the E region of the ionosphere (a complex structure of ionic clouds) was examined in a paper by Messrs. W. J. Bray and R. W. White (Post Office) and Dr. J. A. Saxton and Mr. G. W. Luscombe (D.S.I.R. Radio Research Station). Tests on links showed that a residual signal was always present, having amplitude and phase fluctuations indicative of scattering from numerous variable centres. Both ionospheric disturbance and meteoric ionization appeared to contribute to residual signals.

Scatter signal propagation was best suited to restricted bandwidths, e.g. telegraphy at 100 bauds or less and telephony of not more than 3 kc up to 1,200 miles. Ionospheric scattering afforded a useful means of communication from 25 to 60 Mc/s, but much of this band was already in use in other countries for other services. A 50-baud frequency-shift teleprinter service of substantially continuous availability was practicable except perhaps during rare auroral disturbances. A simple form of wave-angle diversity reduced the number of errors due to short-duration cancellation fades. Continuous operation of high-speed single-channel or multi-channel time-division telegraphy links was unlikely to be satisfactory.

A continuous telephony service would necessitate an uneconomic transmitter power, but 50 per cent availability confined to daylight hours would not be impracticable. Single side-band amplitude modulation was preferable to phase or frequency modulation. Scatter propagation circuits were relatively immune from disturbance by ionospheric storms and were more reliable for telegraph circuits; also frequency changes were unnecessary as compared with normal short-wave propagation.

### Discussion

Mr. G. Millington (Marconi's) said that a big contrast might have been expected in scattering over the sea and over mountainous regions. If one were confined to one component, reciprocity should no doubt hold, but if two unseparated components came back non-reciprocal effects could be expected.

Mr. C. M. Minnis (D.S.I.R.) referring to discrepancies in m.u.f. calculations, suggested that the F1 layer should be taken into account. The height normally assumed for the F1 layer was probably too great, which would account for the normally assumed value of the m.u.f. factor for the F1 layer being too low.

Mr. G. O. Evans (P.O.) showed a slide which illustrated how, during the winter, there was good agreement between predicted and measured performance, but as summer approached that agreement gradually became less.

Mr. W. R. Piggott said that the earth was quite rough from the radio aspect. A mountain was not necessarily any better as an echoing object than the ground as a whole.

Mr. J. A. Smaile referred to the use of a smoothing circuit, related to 15 sec, when recording the signal strength in two directions. That would have smoothed out very sudden fading, which possibly could be non-reciprocal.

Mr. P. J. Redgment submitted that scatter from sea and broken country needed further investigation. Experimental evidence of the relative altitudes would be interesting in siting direction finders.

Dr. E. C. S. Megaw (Admiralty) said that in the paper on v.h.f. propagation by ionospheric scattering, the references to the relationship between wavelength and the scale of turbulence did not make clear whether " scale of turbulence " meant eddies, or whether it was something like the RO, which was essentially a length and represented the biggest irregularities in the whole field.

Dr. R. L. Smith-Rose (D.S.I.R.) held that although communication was possible over a limited distance of 1,000 to 1,200 miles, further investigations would show the system to be extravagant and inefficient.

Mr. E. V. D. Glazer (S.R.D.E.) said that the interference aspects quoted in the paper were very real, and to the sporadic E type of interference must be added outgoing interference to TV receivers. In the area in front of the transmitting aerials the field strength was many volts per metre, and direct pick-up in television receiver i.f. wiring was a serious possibility. That and other aspects tended to favour the use of coastal sites.

Dr. J. W. Findlay (M. of S.) pointed out the need for considering the question at low latitudes. More information about the scattering process was required. The work on vertical incidence having been carried out fully, the size and shape of the irregularities in scattering should be ascertained.

# VIEWS on the NEWS

*By REFLECTOR*

MOST of the lay Press has difficulty in distinguishing generating capacity from output of electricity but I would have thought that *The Times*, at least, would be free from error in this respect. Yet I quite often observe this confusion in its reports. For instance, in a leading article one day last week in a reference to the Aswan Dam it was said that the dam would add nine thousand kWh to Egypt's hydro-electric output. Another common error into which *The Times* also falls now and again is in the use of the term " blue print " to describe a scheme or policy which has not yet been finally worked out.

* * *

The conditions of sale laid down by the Dutch author of a recently-published electrical treatise are worth recording. It will be seen that they embody the offer of a reward to a " common informer "—if the author's claim comes off:—

> " To whom this may concern: Only the red cover edition (at $15 a copy) is permitted on the premises of a manufacturer of electric machines and/or cables. On the cover and title page of the blue cover edition (at $5 a copy) it is clearly marked that such a book is not permitted on an aforesaid manufacturer's premises. Anybody providing proof of a violation to the satisfaction of the Court receives 50 per cent of the net proceeds of any action brought. The claim for damages will be at least 100 times the cost of the allotment mentioned in the FOREWORD. The books of the red cover edition carry the imprint 'Electric Manufacturers Edition' on the cover. At the top right hand corner of the title page the name and country of the pertaining manufacturer as well as the author's signature are to be found."

* * *

I am reproached by Mr. W. R. Cummings, of Inverness, for my " somewhat stupid attacks on gas cooking." I protest: all I have done is to counsel electrical people to cook electrically, which, to my biased mind, seems not to be unreasonable. I am ready to concede that gas cooking has its points but there is a tendency for its advocates to compare the modern gas cooker with an out-of-date electrical one. Gas had a good start in this field but the fact that many thousands of electric cookers are now in use suggests that there is something in electric cooking that the gas enthusiasts choose to ignore. I may retaliate by saying that I am very tired of the continuous attacks on electric cooking and particularly unhappy when they are made by electrical men.

* * *

About a year ago when the Yorkshire Electricity Board contemplated supplying money boxes to enable "quarterly" consumers to save up against their bills I suggested that they would have to be foolproof boxes to be really effective as consumers might be tempted to take back some of their money in emergency. Mr. J. Harley, A.M.I.E.E., of Llanelly, then said in a letter that it was wrong of me to doubt the consumers' honesty to which I replied that honesty was not in question for it was still the consumers' own money. Now Mr. Harley refers to a recent case in which a consumer forced open the box of a prepayment meter, and on being prosecuted by the Electricity Board pleaded that he intended to pay up when the meter was read. The High Court decided that money put into a prepayment meter became the property of the Electricity Board and sent the case back to the magistrates who had dismissed it. Mr. Harley says that there is no doubt whatever that this ruling would apply to the before-mentioned money boxes. There is a difference in the pay-as-you-use system and quarterly payment in arrear, however, which makes me not quite so sure about it as Mr. Harley is, even if the " savings " boxes do belong to the Board. Probably all the Board could do would be to sue for any damage caused to its boxes.

* * *

In Canada, according to the *Evening Standard*, golf is becoming mechanized: " More golfers are making use of electrically-operated cars to carry themselves and their equipment from tee to tee." That seems insufficient justification for the comment: " It is the combustion engine era in golf. The Atomic Age cannot be far off."

* * *

Protests have been made in Cork about contracts for installation work being placed by public bodies with the Irish Electricity Supply Board—a thing which is not unknown here. The complainants say that the Board is able to underquote by omitting the usual retail margin when quoting for equipment. A deputation from the Electrical Trades Association was told that the public bodies were forced to accept the lowest tender for a contract, whereupon a member of the deputation suggested that where an E.S.B. tender was received it should not be opened. This proposal failed to find support.

* * *

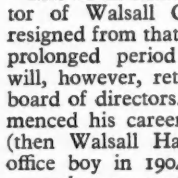
Seventy years ago arc lamps were the vogue for public lighting and it may be of interest now to reproduce two notes from the *Electrical Review* of 14th November, 1885:

> " The City Lighting.—On Tuesday evening the Brush lamps around Ludgate Circus were observed to go out, and one, we believe, was completely destroyed by burning up. It is but rarely that one has to chronicle such an occurrence, and it would be interesting to know the cause of the failure."
>
> " The Lord Mayor's Show.—The erection in Aldersgate Street representing the old Alders Gate 'as it was 100 years ago,' was illuminated by means of four Pilsen arc lamps, supplied by Messrs. Paterson and Cooper, and run from a Phœnix dynamo at that firm's works in Little Britain. We suppose the learned gentlemen who superintended the decorative arrangements in Aldersgate Street know best, but we were certainly under the impression that the invention of the Pilsen arc lamp was of more recent date."

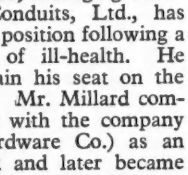
# PERSONAL AND SOCIAL

## *News of Men and Women of the Industry*

**Mr. A. E. Millard,** managing director of Walsall Conduits, Ltd., has resigned from that position following a prolonged period of ill-health. He will, however, retain his seat on the board of directors. Mr. Millard commenced his career with the company (then Walsall Hardware Co.) as an office boy in 1904 and later became general manager of the Ablewell Street premises, Walsall. The whole of the manufacturing side of the company was transferred to Excelsior Works, West Bromwich, in 1929 to join the tube mills and part of the iron foundry which were already there. When the company was made public in 1936 Mr. Millard was appointed managing director. Last year he received gifts from the employees of the company



*Mr. A. E. Millard*



*Mr. L. H. Butler*

to commemorate the completion of fifty years' service with the company.

Mr. Millard is succeeded as managing director by **Mr. L. H. Butler,** who has been assistant manager. Mr. Butler has been in the service of the company for twenty-seven years and has been a director since 1945.

**Mr. C. E. Beames,** district commercial manager, District 348 (Cardiff West), South Wales Electricity Board, has retired after completing twenty-three years' service with the Board and the Cardiff Electricity Department. For twenty-eight years previously he was engaged in the contracting side of the electrical industry. He has been succeeded by **Mr. P. Wiseman,** who was formerly assistant district commercial manager in the Cardiff West District. The forthcoming retirement of **Mr. C. C. Wilde,** A.M.I.E.E., district commercial manager, District 466 (North Breconshire and Radnorshire), is also announced. Formerly Mr. Wilde was manager of the electricity undertaking of the Llandrindod Wells Urban District Council and in all he has been in the service of the electricity supply industry for fifty-one years. Although retiring from his present appointment, it has been arranged that Mr. Wilde will continue to serve the Board at its Brecon office during the absence through illness of a senior member of the staff. Mr. Wilde will be succeeded by **Mr. G. H. Fannon,** an assistant commercial engineer of the North Western Electricity Board.

**Mr. T. M. Lucocq** has been appointed branch manager of the General Electric Co., Ltd., Swansea. Mr. Lucocq joined the company in 1936 as a general representative. In 1938 he was appointed sales representative, south western district and Devon, for Claude General Neon Lights, Ltd., a subsidiary of the G.E.C. After war service in the Welch Regiment he returned in 1946 to Claude General Neon Lights. He rejoined the parent company as general representative in 1947 and, in March, 1949, was appointed manager, installation supplies department, Cardiff. He is succeeded in that appointment by **Mr. E. Reeves,** of G.E.C. Gloucester branch.

**Mr. T. G. Tanner,** technical director of Birlec, Ltd., has been appointed deputy managing director.

**Mr. John Shirreff** has been appointed vice-president of Johnson Matthey & Mallory, Ltd., the Canadian associate of Johnson, Matthey & Co., Ltd. He joined the parent company in 1927 and in 1949 left to join the Canadian associate.

**Mr. L. R. Girling,** Graduate I.E.E., who writes in this issue on "Automatic Exciter Regulation," commenced his career in 1941 as a power station engineering apprentice with the Stretford and District Electricity Board. He then went to the Northampton Polytechnic, London, for a radio engineering course, and after two years in the Royal Naval Air Service, during which he was engaged on radar maintenance on H.M.S. *Venerable,* he took electrical engineering courses at Wigan and Salford Technical Colleges. In 1951 he was appointed a design engineer in the automatic regulator section of the Instrument and Meter Engineering Department of the Metropolitan-Vickers Electrical Co., Ltd.

*Mr. L. R. Girling*

The Council of the **Electrical Wholesalers' Federation** paid its annual visit to the Scottish Section in the week commencing 10th October, the function being held at North Berwick. Apart from the Council, members of the Councils of the Electric Lamp Manufacturers' Association and the Rubber and Thermoplastic Cable Manufacturers' Association, and a number of chairmen and executives of kindred associations attended. The president and director of the E.C.A. of Scotland were unable to attend as the annual dinner-dance of their Association was held in that

**The Council of the Electrical Wholesalers' Federation with Scottish members at North Berwick**

*Front (left to right): Messrs. C. H. Marr, T. T. Young, R. E. Silvey, T. D. Woods, C. H. Blackburn, and E. H. Stein. Middle: Messrs. T. S. Weston, H. Riley, A. Glenister, G. W. Cartwright, A. N. Kerr, F. Dunnet, and J. Fotheringham. Back: Messrs. A. Baillie, J. Frame, J. W. E. Rutherford, J. H. Scott, A. B. Wildsmith, and J. Aikman*

week. Mr. R. A. Marryat, president of the E.C.A., was present, but Mr. L. C. Penwill, director of the Association, was unable to join the gathering. The programme included golf competitions, sightseeing tours, the annual dinner-dance and the E.W.F. Council meeting.

The golf cup winner was Mr. F. Dunnet, who also received the president's prize of a Parker fountain pen. The second prize (a set of golf hoods) was won by Mr. McIntosh, and the booby prize (a set of miniature golf clubs) by Mr. Everard. The first prize for the ladies' section (an umbrella), given by the president, was won by Mrs. K. Taylor. The second prize (a box of golf balls), given by Mr. T. T. Young, chairman of the Scottish Section, had three claimants and the three ladies cut the cards to find the winner. At the dinner-dance Mr. Young presided and proposed the health of the guests, to which Mr. H. H. Townsend responded. The toast to the ladies was proposed by Mr. R. E. Silvey, president of the E.W.F., and Mrs. V. C. H. Creer responded. The toast of the chairman was proposed by Mr. D. L. Tabraham, to which Mr. Young replied.

**Mr. F. R. Newton,** chief of the Data Department of the British Thomson-Houston Co., Ltd., Rugby, has retired after nearly thirty-six years' service with the company. On leaving Birmingham Central Technical College, Mr. Newton was apprenticed to W. Canning & Co., Ltd., after which he joined Siemens Bros. Dynamo Works, Stafford, in the drawing office, later working as a draughtsman for short periods at Vickers, Ltd., and the Humphrey Pump Co., Ltd. In 1914 he returned to Siemens Bros. but soon afterwards joined the Royal Flying Corps, later holding commissioned rank (R.A.F.). On leaving the R.A.F. in 1920 Mr. Newton joined the B.T.H. Co. at Rugby as a draughtsman, subsequently being put in charge of a section. In 1946 he became deputy chief of the Data Department, taking over complete charge the following year.

*Mr. F. R. Newton*

**Mr. Rodney Kent,** sales director of George Kent, Ltd., left by air on 6th November for South America. He will visit Kent agencies and principal customers, including the oil industry and many municipalities, in Brazil, Uruguay, Argentina, Venezuela, Cuba and Mexico, and will return to this country in mid-December.

Over 200 members of the staff of **Collins Electrical, Ltd.,** and guests attended the annual dinner and dance at the Ardington Rooms, Clapham Junction, London, on 28th October. Mr. C. E. Collins (chairman and managing director) presided and the opportunity was taken to present gold watches to Messrs. G. Hutchings, H. G. Michael, H. Bray and G. F. Kent on their completion of twenty years' service with the company. An excellent cabaret, followed by dancing, rounded off a successful social function.

*Mr. C. E. Collins (centre) with, left to right : Messrs. G. Hutchings, H. G. Michael, H. Bray and G. F. Kent after the presentation of their long service awards*

In the ballot for an assistant general secretary of the Electrical Trades Union **Mr. R. G. McLennan** was elected by 28,000 votes to the 13,000 cast for Mr. J. Byrne. During his 29 years' membership of the union Mr. McLennan has held a number of positions from branch secretary and shop steward to national officer, a post to which he was elected in 1947. In recent years he has been a negotiating officer for the union in electrical contracting, engineering, shipbuilding, railway workshops, films and the B.B.C.

J. & H. McLaren, Ltd., have appointed **Mr. N. A. Deighton,** formerly chief engineer, as chief engineer (sales), and **Mr. J. R. Fish,** formerly chief designer, as chief engineer (design).

**Mr. J. W. Iceton,** of the North Eastern Electricity Board, has been appointed technical assistant to the Jersey Electricity Co., Ltd., and will take up his new duties on 1st December.

Their annual Motor Show dinner was held by **Oldham & Son, Ltd.,** at the Connaught Rooms, London, on 27th October when Mr. S. J. Wrigglesworth, director and general manager, presided. The health of the guests was proposed by Mr. John Oldham, O.B.E., chairman and joint managing director, who mentioned that the company had now reached its ninetieth year. Referring to the country's economic situation, Mr. Oldham said that it should not be difficult with our experience, skill and common sense to solve our balance-of-payments problems. There was a need for real economy in Government expenditure and far greater productivity in which less political interference would help.

About half the company's business was represented by direct exports and overseas manufacture, a position which they had reached from "scratch" at the end of the war. Paying tribute to the company's research and technical men, Mr. Oldham said that their development work was continuous.

Mr. B. E. Dearden responded for the guests and also proposed the toast of the company. The reply was by Mr. Edward C. Oldham (director). Mr. John Oldham presented the trophy for "the best salesman of the year" to Mr. N. Hallam, of Newton Abbot, and a cabaret show followed.

The usual monthly luncheon of the **Electrical Industries Club** was held at the Connaught Rooms, London, on Tuesday this week, but as Sir Graham Hayman, president of the Federation of British Industries, who was to have been the guest speaker this month, had at a late hour to postpone his visit to the Club there was no address on this occasion. This did not, however, prevent a good attendance at the luncheon.

*At Oldham & Son's dinner: Mr. John Oldham (chairman), Mr. Erik Sundberg (general manager, Tudor Plant, Sweden), Mr. Ole Schledermann (export manager, Tudor Plant), Mr. Orlando Oldham (director) and Sir Charles Henderson (chairman, Société Francaise des Procédés Oldham)*

**Mr. J. M. Brooke,** managing director of the Venner group of companies, was to leave this country yesterday (Thursday) in the *Queen Mary* for a three-week business tour, during which he will visit the Yardney International Corporation, New York, the Magee Hale Park-O-Meter Co.,

*Mr. W. B. Veness (Metropolitan-Vickers Electrical Co.), the retiring president of the Lightmongers, handing over the badge of office to Mr. Tom Jones (Crompton Parkinson), the new president, at the recent annual dinner of the Society held in London*

Oklahoma City, and the Canadian licensees of the Andre-Yardney silver-zince accumulator, Silvercell of Canada, Ltd., in Toronto. Mr. Brooke will return to New York for further business deals before his departure from the United States on 1st December.

On Friday last the **Association of Electrical Machinery Trades** held its annual dinner-dance at the Savoy Hotel, London, over 200 members and guests with their ladies sitting down to dinner under the chairmanship of Mr. F. H. Washington.

Mr. Washington set the tone of the evening in a lively address of welcome to the guests. He said that the members of the A.E.M.T. had often been called the doctors of industry, because of the first aid which they administered to electric motors and other equipment. Their work brought them into contact with all branches of the electrical industry. He paid tribute to the work of Mr. J. T. Morgan, the secretary, and thanked Mr. E. Clark (the treasurer) for the excellence of the evening's arrangements.

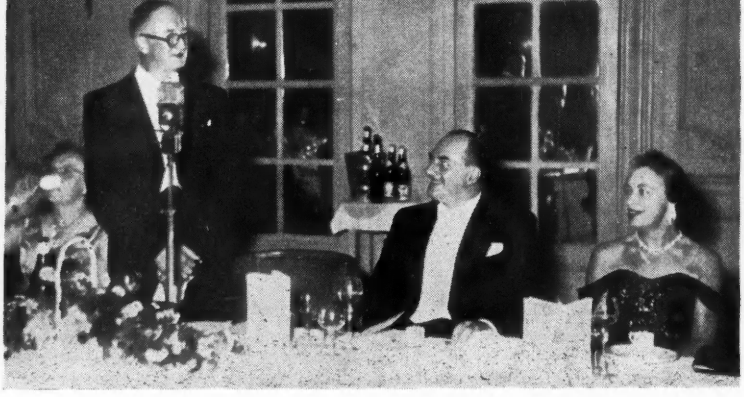
Mr. G. F. Peirson, M.I.E.E., chief engineer of the Midlands Electricity Board, in his reply, said that the service rendered by the Association's members was appreciated by industrialists generally, and more particularly by the smaller firms whose staffs did not include works electrical engineers. He congratulated the Association on its achievements during the ten years of its existence, which, he said, had enhanced the status of its branch of the electrical industry.

In the supply industry interruption of supply due to shortage of plant was now past and they were now gradually improving the reliability and continuity of supply. His Board had been directly associated with the introduction into this country of high-speed automatic reclosers. A more recent introduction was a variation of the American hot line technique which enabled tappings to be made or transformers connected to h.v. lines with the lines "alive."

The dinner was followed by dancing, during which a number of valuable prizes were distributed, the collection for which, amounting to over £50, is being sent to augment the funds of the Electrical Industries Benevolent Association.

A farewell luncheon was given to **Mr. S. F. Steward,** chairman of the South Western Electricity Board, on 21st October at Exeter by the South Western Electricity Consultative Council, when Mr. Steward was presented with an umbrella by Lady Carew Pole, the Council's chairman, on behalf of the members of the Council. As we have already reported, Mr. Steward is resigning from the chairmanship of the South Western Board at the end of the year to take up the appointment of managing director of Lancashire Dynamo Holdings, Ltd.

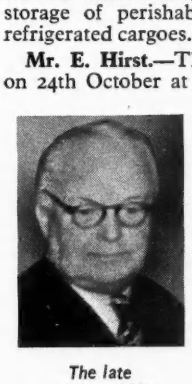
*Mr. F. H. Washington (chairman, Association of Electrical Machinery Trades), proposing the toast of the guests at the Association's annual dinner-dance. On his right is Mrs. Washington and on his left Mr. G. F. Peirson (chief engineer, M.E.B.) and Mrs. Peirson*



## OBITUARY

**Mr. R. L. Potter,** whose sudden death occurred at his Welling home on 25th October, at the age of fifty-six, joined the staff of Elliott Brothers (London), Ltd., in 1923, immediately after leaving Loughborough College. Until 1930 he worked in the test room but then joined the newly-formed heat control division, which he helped to found. Towards the end of the same year he was appointed as the division's first service engineer and, in the years that followed, as service manager built up the present Service Department. Mr. Potter was later appointed divisional sales manager and held this position up to the time of his death. In addition to his wide knowledge of industrial instrumentation, Mr. Potter was an acknowledged expert on the storage of perishable foodstuffs and refrigerated cargoes.

**Mr. E. Hirst.**—The death occurred on 24th October at his home in New South Wales of Mr. Edward Hirst, J.P., who from 1913 until 1940 was chairman and managing director of the British General Electric Co. Pty., Ltd., of Australia, and from 1940 to 1951 vice-chairman and joint managing director of that company.



*The late Mr. Edward Hirst*

Mr. Hirst, who was a cousin and brother-in-law of the late Lord Hirst, joined the head office of the G.E.C., then situated in Queen Victoria Street, London, in 1904. After holding various appointments in the company's home organization, including the managership of the Newcastle branch, he was appointed managing director of the General Electric de Espana, S.A. Later Mr. Hirst became managing director of the General Electric Co. (of Belgium), Ltd. In 1912 he went on a mission to Australia for organization purposes and succeeded so well in this task that in the following year he was offered, and accepted, the post of chairman and managing director of the Australian company. On the appointment of Sir Harry Brown as full-time chairman in 1940 Mr. Hirst became vice-chairman and joint managing director. He resigned in 1951 but remained a member of the board until his death. He leaves his widow, a son and a daughter.

**Mr. Seymour Booth,** a director of the British Vacuum Cleaner & Engineering Co., Ltd., died on 30th October at the age of eighty-one. Mr. Booth joined the company in 1904.

**Mr. Eric Ingram Mavor,** joint managing director of Mavor & Coulson, Ltd., and a director of M. & C. Switchgear, Ltd., died on 6th November.

# PARLIAMENTARY REPORT

IN the debate on the Opposition censure motion on the Government's handling of the economic situation Mr. S. N. Evans said his main charge against the Government was their failure to go to any lengths, to impose any sacrifices, so that we might restore our income from overseas investments. "When we come to embark on this great and imaginative Kariba Gorge Scheme to harness the waters of the Zambesi in Central Africa, we find that the finance is coming from the World Bank. That is a national disgrace," he said. "We have a vast Commonwealth of inestimable use to us and yet our investment in it from 1948 to 1953 amounted to about £35 million."

Mr. Clement Davies, the Liberal leader, thought that to increase purchase tax—a war tax—was bad and that it would not help exports. He thought the Government should tackle monopolies, restrictive practices and price rings; if they did that they would not have to deal with high profits.

Mr. Angus Maude held that British industry was riddled throughout with conspiracies to restrict competition. The most dangerous was the conspiracy within a firm or within an industry between employers and labour to restrict the reduction of costs and prices and thus exploit the consumer. That was rife, and it was fatal to our survival and our future. They could not expect private industry to take much notice of Government exhortation unless the Government could be shown to be doing all in their power to make the nationalized industries efficient, he said.

Replying to the debate, the Prime Minister, Sir Anthony Eden, said it was utterly false for Labour Members to say that the only things the Government were cutting were the nationalized industries. It was false because in their programme was nuclear power, and the coal mining industry had been given a clear bill to try to meet our needs.

The censure motion was defeated by 329 votes to 261.

## Effects of Automation

In reply to Mr. Beswick, Mr. Watkinson, Parliamentary Secretary to the Ministry of Labour, said that the Department of Scientific and Industrial Research was carrying out a special study into the problems of automation on the technical side. As for the general attitude of employers and trade unions towards it, it seemed that through the normal action in industry the question was solving itself quite satisfactorily.

## Radioactive Materials in Factories

Mr. Watkinson informed Dr. Barnet Stross that the Factories (Luminising) Special Regulations, 1947, prescribed the health precautions to be taken in factories using luminous materials containing a radioactive substance. Draft Special Regulations for factories using radioactive substances for other purposes were in course of preparation.

## Scottish Boards' Capital Expenditure

Asked by Mr. Nabarro what contribution was to be made by the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board to the Government's policy of reducing capital investment programmes of the nationalized industries, Mr. J. Henderson Stewart, Under Secretary, Scottish Office, said that this matter was still under discussion with the two Boards.

Mr. Nabarro asked for an assurance that the Scottish nationalized boards were not going to be sacrosanct in the matter of conforming with the Government's revised financial policy.

Mr. Stewart said he had no doubt that they would play their proper part in this national emergency.

Asked about promotional expenditure, he said that for the current financial year the North of Scotland Hydro-Electric Board and the South of Scotland Electricity Board were reducing their expenditure on advertising by about 33⅓ per cent.

Sir Robert Boothby said that, as against the views of Mr. Nabarro, the people in the Highlands realized that the Hydro-Electric Board had brought immense benefits and they had nothing but admiration and gratitude for the expedition and efficiency with which the Board had discharged its duties. Dr. Barnet Stross pointed out that the Hydro-Electric Board produced electricity without atmospheric pollution and therefore should be given the highest priority.

## Cost of Scottish Scheme

Mr. Stewart told Mr. Nabarro that Constructional Scheme No. 31, Tummel Valley, S.I. No. 1469, 1955, provided for 3,900 kW of new plant and would enable 8,000 kW of existing plant, at present idle, to be used. The estimated cost of the 11,900 kW was £113 per kW. The estimated cost per kWh of the 32·7 million kWh to be produced was 0·53d, which was less than the cost of production by any other means and about one-third of the average cost of generating from oil in the North of Scotland District.

## Customs Clearance of Export Samples

Mr. Iremonger asked the Chancellor of the Exchequer what complaints he had had from manufacturers in this country that their export trade had suffered through delay of samples or goods for re-export by H.M. Customs.

Mr. R. A. Butler said that Treasury Ministers received on average about six or seven complaints a year of delay in Customs clearance. Investigation usually showed that the delay had not been caused by the Customs authorities but by the importer or his agent through delay in furnishing the Customs declarations and documents which must be completed before the Customs Officer could examine and clear the goods.

## Transatlantic Telephone Cable

Replying to Mr. William Shepherd, the Postmaster-General (Dr. Hill) said that the cable ship *Monarch* had recently completed the laying of 1,941 nautical miles of telephone cable, including 51 repeaters, across the Atlantic from Newfoundland to Scotland at depths reaching 2½ miles. This unique operation was completed on schedule despite very difficult weather conditions at times. According to present plans the aim was to have the whole system ready for service towards the end of 1956. The House would wish him to congratulate all those on both sides of the Atlantic whose skill had contributed to the successful outcome of this year's operations and to wish them continued success in 1956.

## Scientific Education

Mr. Gilbert Longden asked the Minister of Education what proposals he had in mind to improve the facilities for advanced science teaching in the schools.

Sir David Eccles replied that since 1945 about 1,000 new laboratories had been built or started for maintained grammar and technical schools. He hoped that authorities would continue to use their freedom in minor works to improve science accommodation. If some of these projects could not be carried out for less than £10,000 he was ready to consider them on their merits. As announced in the Press, industry had set up a substantial Trust to give grants towards capital works for this purpose at independent and direct-grant grammar schools. He warmly welcomed this initiative.

In reply to Mr. Willey, Sir David Eccles said that he hoped before long to introduce a bill which would include provisions designed to encourage teachers to defer their retirement.

Mr. David Price asked the Chancellor of the Exchequer what was the total number of science graduates in the United Kingdom and what was the proportionate distribution of such graduates according to broad categories of employment.

Mr. Henry Brooke, Financial Secretary, Treasury, said the number of graduates in pure science (including mathematics) was about 80,000. Nearly

one-third were employed in teaching (in the schools, technical colleges or universities) and about one-eighth in the public service (including the Defence Departments) and the Atomic Energy Authority: some 3,000 or so young graduates were undertaking post-graduate research or instruction courses and the balance were employed mainly in industry.

### Scientific Libraries

In reply to Mr. Willey, Mr. Bevins said the proposals for improved scientific libraries referred to in the eighth annual report of the Advisory Council on Scientific Policy were at present under consideration by the Departments concerned. These projects would involve considerable capital expenditure and the reference library scheme was necessarily bound up with wider questions affecting the Patent Office. He regretted, therefore, that he was not yet able to make a statement.

### East-West Trade

Mr. Dodds asked the President of the Board of Trade, in view of the easing of tension between the East and West, what progress had been made, and what the future plans were, to increase the volume of East-West trade as far as this country was concerned.

Mr. Thorneycroft said that trade with the Soviet bloc countries was increasing. Our exports to Russia were now running at twice the level of 1954 and our imports had increased by one-third. There had also been material increases in our trade with most other countries in Eastern Europe. He was sure that we could continue to rely on the initiative of our exporters to make the most of the opportunities provided by these countries to increase trade in non-strategic goods.

### Atomic Energy Questions

Mr. Gresham Cooke asked the Minister of Works whether he would make arrangements to publish the fullest possible figures indicating the economic basis upon which the Government's plan for building atomic power stations had been drawn up and whether he would include in that information an estimate of the value of the plutonium which would be produced in the atomic reactors.

Mr. Birch replied that this information was in the White Paper, "A Programme of Nuclear Power." Information on the value of plutonium from atomic reactors was contained in a paper contributed to the Geneva Conference on the Peaceful Uses of Atomic Energy on behalf of the United Kingdom Atomic Energy Authority.

Mr. Cooke asked if the Minister was aware that at the British Association meeting Sir Robert Robinson had said that the value of plutonium to be produced would be nil and that, therefore, the production of atomic energy would not be economic? Would the Government refute that idea?

Mr. Birch replied that in the paper to which he had referred it was concluded that the minimum price of plutonium over the next 20 or 25 years would not sink below several thousand pounds per kilogramme.

Mr. Mason asked the Minister of Works if he would make a statement briefly covering the official discussions that had taken place regarding the possibility of a European Atomic Community.

Mr. Birch said that a working party to consider this matter was set up in June by the O.E.E.C.; it had not yet prepared its report, but the Government were keeping in close touch with the progress of its work.

Mr. Hamilton asked the Minister of Works whether he would consider the publication of a fortnightly "Atoms for Peace Digest" similar to that now issued by the United States Information Services.

Mr. Birch replied that the Atomic Energy Authority had under consideration how best it could provide information concerning the civil uses of atomic energy. An announcement would be made in due course.

### Export Credits Guarantee Scheme

Mr. Spence asked the President of the Board of Trade what was the total amount of premiums paid to the Export Credits Guarantee Scheme and the total amount of claims paid for the latest twelve-monthly period.

Mr. Thorneycroft said that in the year ended 31st March last premiums earned under the Credit Insurance Scheme amounted to £2,895,576, claims paid totalled £4,625,853 and recoveries on claims paid in previous years totalled £5,355,361.

### Copper Semi-Manufactures

Mr. Wade asked the President of the Board of Trade what steps he had taken to implement the report of the Monopolies Commission on the supply and export of certain semi-manufactures of copper and copper-based alloys.

Mr. Thorneycroft replied that he had drawn the attention of the trade bodies concerned to the report referred to and had invited their observations on its conclusions and recommendations.

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## Low Temperature Heaters

In our survey of low temperature heaters (21st October issue) the finishes of the Gillott Electro Appliances standard and de-luxe models of the "Cotswold" fan heater were incorrectly given. The standard model is finished in a warm hammered bronze with legs, handle and switches in maroon. The de-luxe model is finished in a warm grey, the legs in a deeper shade of grey and the switches and handle are in ivory.

## NEW E.D.A. FILMS

The latest film to be made by the British Electrical Development Association was shown to the electrical and trade Press in London last Friday. Entitled "Give Us a Ring," the new film describes the advantages of the ring main system of wiring. It is not a technical film, however, and relies entirely upon the story of a newly-wed couple to explain what these advantages are and what the ring circuit system is. A well produced film, it runs for about twenty-six minutes and was produced by Ronald H. Riley Productions, in association with the Film Producers' Guild.

The opportunity was also taken to show what is believed to be the first film or film-strip produced in this country specifically on the subject of salesmanship. Designed for showing at sales training courses, the film "Meeting Her Family's Needs" is the first in a series of "talkiestrips" based upon the five selling points of the sales interview. It explains the service electricity gives and outlines the first step in selling that service. Running time is sixteen minutes and production, in Eastman colour, is by Talkiestrips, Ltd.

Mr. Victor W. Dale (director and secretary, E.D.A.) said in a short talk which followed the showing that the production of E.D.A. films would be stepped up in future and he outlined a programme covering many domestic subjects which were to be shown during 1956. Several of the educational films were to be revised.

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## PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

| | |
|---|---|
| ALUMINIUM Ingots | ton £171 0s 0d |
| COPPER, H.C. Electro | ton £371 10s 0d |
| Fire Refined 99·70% | ton £370 0s 0d |
| Fire Refined 99·50% | ton £369 0s 0d |
| COPPER Tubes .. | lb 3s 7⅞d |
| Sheet .. .. .. | ton £436 10s 0d |
| H.C. wire and strip .. | ton £423 15s 0d |
| LEAD, English .. | ton £106 10s 0d |
| Foreign .. .. | ton £105 0s 0d |
| MERCURY .. .. | flask £90 10s 0d |
| TIN, block (English) .. | ton £769 10s 0d |
| ZINC, G.O.B. Foreign | ton £91 0s 0d |
| Electrolytic .. .. | ton — |
| BRASS Tubes (solid drawn).. .. .. | lb 2s 10⅜d |
| Sheet .. .. .. | ton £347 5s 0d |
| Wire .. .. .. | lb 3s 5⅜d |
| PHOSPHOR BRONZE Wire .. .. | lb 5s 2d |
| PLATINUM .. .. | oz £32 10s 0d |
| RUBBER, No. 1 R.S.S. spot .. .. .. | lb 32⅛d—32⅜d |

## Commercial Travellers

The Annual Court of Governors of the Commercial Travellers' Benevolent Institution will be held at the Berners Hotel, Berners Street, London, W.1, on 31st December next.

# INDUSTRY AND THE HOUSE

*Commentary on the Budget Debate*

By A. M. F. PALMER, A.M.I.E.E., M.P.

WHEN the House of Commons adjourned for the summer recess it had not attained any obvious post-election stability. Government supporters had not adjusted themselves to the responsibilities brought by their good fortune at the polls; the Opposition were still, it must be confessed, a little ragged and dispirited. But the peace and quiet of the sunny summer months away from Westminster appear to have done a power of good to legislators. The Conservative Party is now quite properly in a sober mood feeling the full weight of the burden of office; the Labour Party is both happier and more aggressive. Labour is also obviously delighted that the old enemy the Chancellor of the Exchequer seems to have been caught out at last.

Supplementary Budget Day saw the parliamentary stage fully set for a major performance. The green benches were packed with their full quota of compressed humanity throughout questions; Opposition supporters leaning forward like spectators at a football match, anxious not to miss a single moment of the game; Government members bolt upright by contrast; mentally ambivalent, in one mood desiring a strong hand at the helm, in another wistfully concerned at the consequences in the constituencies they had left in triumph so recently.

Loud ironical cheering from the Opposition greeted the arrival of the Prime Minister, which grew to a roar of shouts and jocular comments as Mr. Butler followed a moment later, holding high the famous red box. The contents of the red box are now so well known that it would be tedious to repeat the details. Sufficient to say that Mr. Butler probably hopes by means of his changes to place a brake on inflationary tendencies in the full-employment economy, while retaining at the same time the free enterprise principles to which he is committed as a matter of doctrine. His method is to cut spending by the Exchequer and the nationalized industries; to make still more expensive the borrowing of money by public authorities and individuals; and to discourage private buying by all-round increases in purchase tax. His Labour critics for their part are anxious to show his methods do not work and that he has been politically dishonest in not admitting it before. That is perhaps to be expected for most things are fair in love, war and politics, but Mr. Butler was not assisted during his speech by the glumness of his own supporters, many of whom felt perhaps that the Chancellor's purchase tax increases were likely to infuriate the housewife and give encouragement to new trade union claims.

## Former Chancellor's Criticisms

Mr. Gaitskell, Labour's former Chancellor of the Exchequer, made these same points very ably when he led for the Opposition in what has perhaps been the most outstanding parliamentary speech of his career. On purchase tax Mr. Gaitskell said that there might have been an argument for picking out particular goods for heavier duty in the home market to assist the export trade, but the sweeping, indiscriminate increase now proposed was thoroughly bad. He went on to ask if the Chancellor was planning to convert the patched up purchase tax system into a permanent sales tax? On wages he argued that the higher prices and rents resulting from the Butler policy would be followed by what he called " legitimate demands " for higher pay. If this did happen and led in turn to higher production costs the responsibility must be that of the Government. Had the Chancellor of the Exchequer been less anxious to court electoral popularity in the spring Mr. Gaitskell thought he might not be facing his present autumn troubles.

For the electricity supply industry the most serious revelation of the Budget debate is the Government's request that the Electricity Boards make an all-round cut in capital expenditure. The only small crumb of comfort is that the cuts are not to apply to the urgently needed nuclear power programme. Once again the industry is also the victim of official prejudice against so-called " promotional expenditure." On this Mr. Gaitskell had said that the Opposition did not object to the Government controlling the investment programmes of nationalized industries—this facility was one argument for nationalization—but they did protest against policy which inflicted unfair restraints on nationalized industries just because they were nationalized. Mr. Austen Albu (Labour, Edmonton), who spoke later, argued that the effect of allowing industry which consumed the products of basic industries to grow while cramping at the same time the productive capacity of basic industries might be serious.

One Government back bencher, however, was almost lyrically enthusiastic about the attack on electricity. This was Mr. Nabarro, of Kidderminster, who declared that " millions of pounds every year " were used by the Electricity Boards " in the pursuit of commercial activities not of a productive character." His thirst for blood was so great that he seemed to regret that the Chancellor had not gone even further.

## Policy Defended

The Budget debate continued for two days, when it merged into a vote of censure moved by Mr. Herbert Morrison. By then it must be owned, starting with the speech of Sir Edward Boyle, one of the ablest of the younger Conservative Ministers, on the previous Friday, that the Government, which reeled a little at the first Opposition onslaught, had made a recovery. In a spirited defence of his policy, Mr. Butler twitted the Labour Party with allowing rivalries between their leaders to obscure objective thinking on the country's economic problems. He returned Mr. Gaitskell's earlier charge of " dishonesty "—which Mr. Butler, it is said, has taken much to heart—by noting that only one name was missing from the list backing the censure motion—that of Mr. Aneurin Bevan. Having heard Mr. Gaitskell's speech there would be no need in future for Mr. Bevan " to stoop to conquer! "

The Chancellor denied that his Budget was unfair. Nothing, he said, could inflict greater wrong on working people than to allow inflation to continue unchecked. Reasonable criticisms would be taken into account by the Government; with the Prime Minister and the Minister of Labour, he proposed to meet the T.U.C. to discuss aspects of his proposals which concerned industrial relations. Since then Mr. Butler, as reported in the Press,

has been in conference with the Economic Committee of the T.U.C.; the House may hear a little more of what transpired then when we reach the Second Reading of the Finance Bill necessary to implement the Budget changes.

On Thursday last the House took the Second Reading of the Clean Air Bill. This measure was published some months ago, and its provisions are reasonably well known. In introducing it Mr. Deedes, the Parliamentary Secretary to the Ministry of Housing and Local Government, claimed it was based upon the recommendations of the Beaver Committee and outlined the series of practical steps which he contended would within a short term of years make the industrial towns of the country cleaner and healthier places to live in. Although the Bill is in principle non-controversial as between the parties, it was very evident from the debate that its details are not likely to receive an easy passage in committee.

Starting with an ex-Minister, Dr. Summerskill, back bencher after back bencher (including some Conservatives) complained that the " escape clauses " were much too wide and needed tightening if the Bill when it became law was to succeed in achieving its declared aims. In particular it is likely that strong moves will be made to reduce the present proposed seven years' " grace " to three years.

## Exports to Dollar Countries

THE urgent need for expanding our export trade in the dollar markets—the United States, Canada, and the Latin American countries—was emphasized by Sir William Rootes, chairman of the Dollar Exports Council, at a Press conference held in London on Tuesday. After stating that during the past few months we had been spending more overseas than we had earned by our overseas trading, Sir William said that this area provided us with great opportunities for the expansion of trade. At the current rate the dollar markets were importing $\$18\frac{1}{2}$ billion worth of goods. In the main, Britain had done a good job since the war in these markets but we had not done enough. In Canada, whose imports from the United States had risen from 63 per cent before the war to 75 per cent to-day, our share of her total imports had sunk from 18 per cent in 1938 to $8\frac{1}{2}$ per cent, and in the Latin American dollar account countries our existing figure of 4·6 per cent had not reached our pre-war share of 7 per cent. In the United States we made a better showing, for whereas it was 6 per cent before the war we were now back to 5·3 per cent.

Sir William instanced some of the promotional work which the Dollar Exports Council was doing. It had trade centres in Canada and the United States which were ready to give advice and help, particularly in the form of contacts, to all British business men, while in the Latin American markets it had appointed leading business men to act as its trade correspondents in virtually all countries.

Mr. A. R. W. Low, Minister of State, Board of Trade, referred to the sharp increase in our dollar import bill this year and said that imports of this order could only be sustained by a large volume of exports. The Government attached great importance to the dollar markets, not only because the dollar remained a more desirable currency than others, but also because of the great opportunities which they offered. With its high level of prosperity the United States offered a rising demand for the imported manufactured goods of which our trade principally consisted, and in Canada great opportunities existed for almost all classes of manufactured goods. The greatest scope in the Latin American countries was in the field of plant and machinery, but there was also a market for some consumer goods.

## Recording System Faults

A DISCUSSION on fault recording instrumentation on a power supply system was held on 1st November at the Institution of Electrical Engineers (Measurement and Control Section). Mr. W. Casson (Central Electricity Authority), in opening, stressed the importance of obtaining full information on the type of a disturbance, its duration and its effect. Some of the information was needed quickly so that the operating staff could restore or safeguard supplies, and some of it could be collected at convenience.

Apart from indications of protective gear operation, switchgear operation and alarm schemes during a disturbance, the information should include currents and voltages at different points on the system before and at various stages during and after the disturbance. From this information its cause could be deduced. Correct deduction was necessary to avoid danger of reclosure on to a fault or of recommissioning a circuit with a latent fault leaving the system insecure and also to enable action to be taken in order to reduce the possible risk of similar faults recurring.

System disturbances, which consisted of system faults, overloads, instability and sudden unplanned changes in the flow of reactive power, might change in character during disturbances and there might be simultaneous faults of different types, so that it was desirable to get records of any such changes. Abnormal occurrences were usually inadvertent operations of circuit-breakers due to defects in the protective scheme or associated equipment or to incorrect hand operation.

Information on electrical quantities associated with disturbances and abnormal occurrences was normally needed for determining the cause. The quantities that could be measured included phase currents, residual and neutral currents, phase-to-neutral voltages, phase-to-phase voltages and residual voltages. Information on load and reactive-power-flow conditions might be important when determining the performance of directional relays.

In measuring currents and voltages it was sometimes not sufficient to record power-frequency quantities; the recording of short-duration transients, sometimes lasting only a few microsecs, and the timing of the operation of circuit-breakers and protective gear might also be desirable.

The quantities to be considered covered a wide range, the problem being aggravated because of variations in the periods of record from a few microsecs to a minute or so. Clear distinction had to be made between the recording of power-frequency quantities and transients of shorter duration. Practical restrictions on the amount of equipment that could be installed entailed choice of the most important quantities to be recorded.

Mr. L. Csuros (C.E.A.) then discussed fault recording instruments in two main groups: those recording only the maximum value of changing qauntities, and the chart and oscillographic recording instruments. In deciding on the amount of equipment, he said, one factor was its maintenance and the collection of the information provided. Another was its cost and the impracticability usually of installing equipment to give full information. Among the basic factors that designers and operators had to face were the quantities to be recorded and their relative importance, choice of recorder, usefulness of schemes incorporating some form of " memory," the merits of different starting schemes, the practical extent of permanent instrumentation, transportable types, and the evaluation of information on protective gear.

# Clean Air Bill

## SECOND READING DEBATE

THE Government's Clean Air Bill, which was debated on second reading in the House of Commons last week, was criticized by a number of Members who felt that it did not follow closely enough the recommendations of the Beaver Committee and contained so many "savers and waivers" that it might have little effect. But there were many Members who believed that the Bill was a good initial step in the process of cleaning the atmosphere and that it attempted to do as much as was practicable. Mr. Nabarro thought the Bill would have to be given far more "teeth" if it was to be truly effective. The provisions of the Bill were summarized in the *Electrical Review* of 5th August.

Moving the second reading, Mr. W. F. Deedes, Parliamentary Secretary, Ministry of Housing and Local Government, said the Bill would involve the improvement and alteration of many industrial plants and on this account the Beaver Committee recommended a period of seven years in which the work could be done. The Bill ensured that any large furnaces installed in future must be equipped with efficient arresting equipment.

### Sulphur Pollution

Sulphur gases were one of the most harmful forms of pollution but the problem of prevention was intractable and could not be cured, in the present stage of technical knowledge, by legislation. Progress must be in the development of a satisfactory method of removing sulphur dioxide from the flue gases of large fuel-burning installations, such as power stations, and research into preventing or reducing the release of sulphur when fuel was burnt. The Government had accepted the Committee's recommendation that the most efficient practicable method should be used in the new power stations in or near populated areas. In reply to a question about existing stations, he emphasized that he had said "new stations." Mr. Deedes went on to say that it was not necessary that the Clean Air Council, which would be set up, should be a statutory authority; Ministers would consult it on the ways of effectively implementing the clean air policy. It was proposed that all the provisions referring to industrial smoke, grit and dust should come into operation in the early part of 1958. The smoke-controlled area provision need not wait until 1958; it would be unreasonable to hold back the financial assistance which the Bill gave to householders, therefore the Government proposed to fix the appointed day for these provisions as soon as practicable after the Bill became law.

Asked by Mr. Nabarro what would be the appointed day for Clause 2, which allowed exemptions for a period of seven years from the day appointed, Mr. Deedes said Members would no doubt want to debate this; at the moment, he had nothing to add. Some people had said the Bill did not go far enough, but there were few examples in history of a committee's proposals being put into legislation so quickly.

Dr. Edith Summerskill, the Opposition's leading speaker, said the Bill seemed to provide a mesh through which the indifferent or incompetent producer of smoke could escape. One need go no farther than Clause 1 (3) which prohibited dark smoke from chimneys, then gave a factory owner the chance to plead successfully that the fuel used was unsuitable. The lowest grade of fuel could be used provided the equipment was efficient and there was a skilled man in attendance.

Mr. Gerald Nabarro said it was vital to have at the outset an unequivocal declaration that it was the national policy to secure clean air. The Bill had serious shortcomings: it was ill-drafted; it was too leisurely; it had wide escape routes; and the hand of the Federation of British Industries was writ large between the lines. His principal criticism was that the seven-year dispensation in Clause 2 was far too long in view of the urgent need for fuel efficiency in industry and he would later move to substitute three years. In American and Canadian cities it had been demonstrated over long periods that their definition of smoke could be supported in the courts. He complained that there was no provision in the Bill for the training and certification of industrial boilermen and that the tax incentives in respect of fuel economizing plant, recommended by Sir Hugh Beaver, had been forgotten by the Chancellor of the Exchequer. To be effective and thrusting, the Clean Air Council should be part of the legislative instrument.

Mr. S. Storey said that the Clean Air Council, given the right powers, could be a useful body for encouraging and co-ordinating research into eliminating sulphur. Throughout the Bill there were loopholes which would delay achievement of the Bill's aims.

Dr. Somerville Hastings said that it was not smoke, but the irritant action of the oxides of sulphur which was most likely to be the cause of death. He thought there should be a statutory council with power to initiate research into clearing sulphur from the air. He recalled that Sir John Cockcroft had said that in 1975 nearly half Britain's electricity would be generated by atomic power, saving 40 million tons of coal a year and ending the pollution by sulphur oxides. Such a development would do more good than a dozen Clean Air Bills.

Mr. C. R. Hobson also declared that the real, deadly problem was sulphur. One of the worst polluted spots in Britain was in Willesden where he had lived for many years and had worked in the power stations. The three stations were emitting what appeared to be a colourless vapour but it was sulphuric acid gas which rotted away furniture coverings and curtains in the houses nearby in one month. Another danger which was omitted from the Bill was the emission of carbon monoxide gas from car and lorry exhausts. The railway "dieselization" programme would increase that pollution. It would be far better to electrify the railways and restrict the smoke nuisance to power station areas.

### Problem of Domestic Fires

He was amazed at the praise given to smokeless zones. Though there might be no smoke, sulphur gas was still emitted from the household fires. The only way in which a clear atmosphere could be obtained was by the use of gas or electric heating and it would, of course, be politically impossible to compel people to have such fires instead of coal fires. The Bill should contain clauses compelling workshops and factories to be completely electrified. Power stations should be placed in the sparsely populated areas.

After paying a tribute to what the electricity authorities had done to try to avoid the sulphur nuisance he said that sulphur in any form of gas was easy to eradicate in the laboratory; it was when they came to apply it to modern industry and power stations that they fell down. If capital were made available—and in their large boiler firms they had combustion engineers second to none—in a short time the problem could be eradicated. Parliament ought to make it compulsory for the stacks of power stations to be two and a half times as high as the highest part of the buildings, thus giving a greater distribution of the gases.

Mr. Charles Fletcher-Cooke wondered whether the scientists had considered the possibility of making artificial wind to blow away "by some giant's hand" the fogs that hung over large cities.

Mr. E. W. Farey-Jones spoke of the steadily declining quality of fuel supply to electricity and gas undertakings and

said that unless the quality were improved the position would continue to deteriorate. He called attention to a series of successful experiments with high carbon coke carried out in the United States and Germany.

Replying to the debate, Mr. Duncan Sandys, Minister of Housing and Local Government, assured those who had complained about loopholes and escape clauses that the Government wanted a measure which would be effective and workable and would achieve results as quickly as possible. It did not serve this purpose to ask people to do something that was not practicable. All they would do would be to kill the whole policy if they produced a Bill which was so difficult to carry out that the administration had to allow evasions. He took no exception to including in the Bill that clean air was a national policy. He was willing to make the appointed day for the beginning of the seven-year period the day after the passing of the Bill. Even with efficient stoking and the most modern plant, he was advised that it was not always possible to avoid the emission of dark smoke if unsuitable fuel had to be used.

Members had referred to the serious effect of sulphur and other fumes. The Government realized the seriousness of this but, unhappily, there was no complete answer to it as yet. Research was being energetically pursued by the D.S.I.R. and other organizations. The C.E.A. was at present constructing a full-scale pilot plant for carrying out extensive trials at a power station. The research projects included experiments for the creation of artificial wind.

He had it in mind to bring into force the clauses providing for the creation of smoke-controlled areas within a few months of the passing of the Bill.

Concluding, he said that the House was united in their determination to eradicate what was a great social and economic evil—a menace to the health of the people and a source of disgraceful waste and destruction. In committee he hoped they would make the Bill an effective instrument to achieve their common purpose.

The Bill was read a second time and committed to a Standing Bill Committee.

## Atomic Power in Scandinavia

SWEDEN has large uranium resources apart from her ample supplies of cheap water power. There are some 4,700 million tons of uranium-bearing shale in Närke and Västergötland, although the concentration is low—about 175-200 grammes per ton.

The first Swedish reactor was started in July, 1954, and is intended for experimental purposes only. It contains about 3 tons of uranium in the form of uranium bars sheathed in aluminium tubes. The moderator consists of 6 tons of heavy water, purchased from Norway, and the reactor is air-cooled. The power rating is 300 kW. The reactor is of the same type as heavy water reactors in other countries.

The first stage in constructing a larger experimental reactor plant generating some 20,000 kW has recently been commenced. It is anticipated that the increased possibilities of obtaining technical "know-how" and material from abroad made possible by the Geneva Conference will lead to the reactor's being constructed on more advanced principles and in less time than had been estimated previously. It is thus possible that the construction of Sweden's first atomic power station can be speeded up and that the station can begin to operate within eight years.

Work and research in nuclear physics in Sweden are vested in the Atomic Committee and AB Atomenergi. The former, founded in 1945, has the primary object of furthering scientific investigation and giving instruction in nuclear physics and nuclear chemistry. AB Atomenergi, founded in 1947, is semi-State-owned and is responsible for the practical application of the atomic energy programme. One of its tasks is to produce atomic power reactors for both domestic use and export. To date, the company has received about 60 million Sw. kronor in appropriations. For the budget year 1956-57 it has applied for 36·5 million Sw. kr., or about twice as much as for 1955-56.

A Nordic Institute for Atomic Research is to be set up in Copenhagen in connection with Professor Niels Bohr's plant for theoretical physics. The cost of the new plant will be borne by Denmark—mainly out of the large industrial funds at the disposal of Professor Bohr—while Norway and Sweden will contribute to running expenses. It is also hoped that Finland will participate in the scheme.

## Fluorescent Lamp Efficiency

AT a meeting of the Illuminating Society on 8th November, Messrs. F. Jackson, R. Molloy and K. Scott discussed factors affecting the efficiency of fluorescent lamps and the quest for higher luminous output. Despite the higher cost of installing such lamps, the authors stated, the numbers in use were increasing and in the U.S.A. exceeded those of the filament type, a favourable influence being that life and light output were not directly inter-related.

One factor limiting progress was the need for the 5ft 80 W lamp to operate satisfactorily at from 200 to 250 V, although 70 per cent were supplied at 230 V and above. A similar lamp but slightly longer for 230 V would be more efficient, while the use of 240 V everywhere could result in the development of lamps of higher efficiency with different dimensions and electrical characteristics.

The highest light output of a given fluorescent lamp was obtained at a specific operating temperature, as determined by its dimensions and voltage loading and by the ambient temperature. To light the chilly halls of Britain the 5ft 80 W lamp was preferred, the highest light output of which was obtained at 8 deg F below the optimum temperature for the 4ft 40 W lamp used extensively in the temperature-controlled buildings in America. Laboratory-made fluorescent lamps at present gave about 4 per cent more light than factory-made lamps, owing to the subjection of the fluorescent phosphor in the latter to conditions of temperature and atmosphere that reduced the efficiency with which it absorbed ultra-violet radiation and emitted visible light. While best phosphors had an efficiency between 80 and 90 per cent, denoting that no revolutionary advance was possible, the maintenance of this efficiency would gain in importance as lamp life continued to increase. Empirical achievements were at present ahead of theoretical explanations. Although krypton instead of argon as a filler gas would raise light output, it would result in a reduced arc voltage, so that substantial current increases would be necessary to maintain the voltage of lamps of existing dimensions. Krypton lamps also required much more expensive starting and control gear than was justifiable.

## German Fuel Cell

A SMALL experimental fuel cell was recently demonstrated in Western Germany by Professor Eduard Justi, of Mainz. The apparatus consisted of a jar of caustic potash in the centre with a cylinder of hydrogen on one side and a cylinder of oxygen on the other. Two electrodes in the jar were connected to a small electric motor driving a wheel painted black and white so that the audience could see it move. The gases were separately piped into the caustic potash through measuring and controlling apparatus. Professor Justi claimed that this method, which could be applied to other gaseous or liquid fuels, apart from hydrogen, provided they were sufficiently inflammable, had an efficiency of 70 per cent.

The hydrogen and oxygen enter the potash solution in the jar through the hollow electrodes, one being made of porous carbon (for the oxygen) and the other of porous nickel (for the hydrogen). If gases of normal industrial quality are used it is claimed that the electrodes would remain efficient for some months. The apparatus operates at just above room temperature and produces almost one volt, the current level remaining practically constant. Professor Justi said that British scientists had developed an apparatus based on the same principle, known as the Bacon cell, but it needed specially pure gases for its operation and worked at a temperature of about 200 deg C.

# New Rugby Radio Station

## I.E.E. PAPER AND DISCUSSION

PARTICULARS of the second radio transmitting station at Rugby, which was formally opened in July, were given in a paper presented before the Institution of Electrical Engineers on 3rd November by Captain C. F. Booth (P.O. Engineering Dept.) and Mr. B. N. MacLarty (Marconi's Wireless Telegraph Co.).

The new station, the authors stated, contained 28 transmitter-amplifiers for independent side-band operation (i.e. a form of multi-channel telephone and telegraph working in which the radiated signal consisted of a reduced carrier wave and two or more side-bands conveying independent signals) within a frequency range of 4 to 27·5 Mc/s. Peak envelope power was 30 kW for telephony and 20 kW for frequency-shift telegraphy.

Upwards of 70 aerials (rhombic except for the New Zealand service, for which a stacked array of dipoles was used) would be employed to cover transmission beamed on all main traffic routes. Air cooling was adopted for the high power transmitters, as noise was not troublesome.

Despite a wide variety of service requirements, a considerable amount of standardization of equipment had been achieved. Flexibility to provide for future changes in demand for the different classes of service had been obtained by dividing each complete transmitter into two parts—a low power drive unit and a high power amplifier. The first of these were of two types, one catering primarily for multi-channel i.s.b. telephony and the other for single- or multi-channel telegraphy, including facsimile, using frequency shift or on-off keying.

### Remote Control and Monitoring

To minimize operating staff, remote control and remote monitoring had been largely adopted. Any one of the 28 transmitters could be switched to any one of the assigned frequencies, connected to the appropriate aerial and monitored during operation, all from a central control position, staff being employed on individual transmitters only for maintenance or when new frequencies were assigned.

Details were given of the internal plant which included the following items: land-line terminal plant for connecting with London; transmitter drive units; fixed frequency oscillators ($\pm 30$ parts in $10^6$); automatic signal equipment and aerial switches.

Power supply was taken at 11 kV from the old Rugby station (which remained an important part of the oversea radio network) by two 1,400 kVA separated underground feeders serving two interconnected substations, each containing three 500 kVA transformers (one spare). Protection was by a balanced current system in which the feeder was divided into overlapping zones, any one of which was automatically isolated by a fault in it without affecting the supply to the others. The transmitters were supplied in groups from two medium-voltage switchboards; since the mercury-arc rectifiers in the transmitters would clear overloads faster than a circuit-breaker, the m.v. feeders were protected only against catastrophic failure by h.r.c. fuses both in the grouped and individual supplies to the transmitters.

An emergency supply was obtainable from diesel sets in the old station, two new 900 kVA sets having been installed to supplement the output of an existing 1,400 kVA unit. Experience since the new station was brought into limited service in October 1954 had confirmed the advantages of providing a common type of high power linear amplifier for use with either telephone or telegraph drive units. The layout and main features of the station were described in the *Electrical Review* of 5th August.

### Largest H.F. Station

Opening the discussion Mr. H. Stanesby (Post Office) said the h.f. station described was the biggest ever to be built as a single project. It pointed the way to the future in the high efficiency of its component units, cleanness of design, economy in man-power, and reduction in ineffective transmitter time due to automatic frequency changing and aerial switching. In twelve out of thirteen recent measurements around the station of spurious emission from the transmitters of harmonics in the television band on frequencies at which the interference would be highest, the signals contained only 0·01 of the energy necessary to give a tolerable television picture. The frequency stability was a good deal higher than was called for by international regulations, and spurious emission just outside the transmission band was very low indeed. Transmission by ionospheric scatter was unlikely to relieve the congestion of the h.f. band, and, while tropospheric scatter might be more useful in days to come, for the next few years higher performance was needed to squeeze in new services.

Mr. H. Faulkner (T.E.M.A.) congratulated the designers on using air cooling for the transmitters; it had proved effective, and the noise was low. The application of negative feedback was most interesting. The paper provided an example of co-operation between the user (the Post Office) and the manufacturer, neither of whom could have done the job alone.

Mr. J. A. Smale (Cables & Wireless), while admitting that standardization of transmitting equipment gave operational advantages, questioned whether economic advantages could be claimed for it. Once a transmitter had settled down to its normal business of providing a service to a certain part of the world, he said, it was not economic to have a lot of equipment on it which was not essential for that service.

From the figures given for feeder attenuation, and taking into account the unfortunate use of aerials such as rhombics, whereby a further third of the power "went down the drain," there seemed to be an efficiency of about 50 per cent. With 20 transmitters working at a power of 20 kW for 12 hours a day something like 1,800,000 kWh a year was involved, and taking a cost of 5s to generate a kWh of h.f. power the loss would be £200,000 a year.

The authors said that the continuously variable inductor had been evolved over the last 15 years, but it would be more true to say that it had been a confounded nuisance over the last 15 years, and that only very recently had a solution been found which ensured that it did not make itself troublesome, particularly at very high radio frequencies.

Colonel D. McMillan (Post Office), speaking as a user of the station, said that experience to date convinced him that the design fulfilled all hopes. He had little doubt that future developments now in mind would follow precisely this type of plan. The new Rugby station, taken in conjunction with the new receiving station at Brearley,

had brought them to the point where shortage of major radio equipment was no longer a deterrent to the commencement of new services and face to face with the real deterrent—the difficulty with frequencies. The new station made a great contribution towards permitting the most advantageous use to be made of the frequencies available. Multi-destination services, unfortunately, put a premium on high-grade, high-power transmission, so that relatively inefficient receiving equipment could be tolerated at the far end with undesirable effects in a congested ether. Some of their customers, they hoped, would adopt point-to-point transmission for the "main haul" and resort to the broadcasting part only for local distribution.

Mr. A. Cook (Post Office) referred to difficulty in calculating the optimum power to be provided at the transmitter, which depended, among other things, on the performance of the receiving equipment and involved a large number of variables, but they could at least calculate the cost of generating the power and of providing the aerial gain at the transmitting station, and he showed a slide giving a number of calculations of this type.

Mr. A. N. Thomas (B.B.C.) and Mr. W. J. Morcom (Marconi's) also took part in the discussion, to which Mr. B. N. MacLarty briefly replied.

# Atomic Energy and Coal

*Mining as a Processing Industry*

THE seventh W. M. Thornton Lecture was delivered by Dr. J. Bronowski on 28th October before the Association of Mining Electrical and Mechanical Engineers. In this he gave an estimate of how atomic energy would affect coal mining in this country.

After outlining the Government programme of last February for the building of twelve nuclear power stations with an aggregate capacity of 2,000 MW within the next ten years, supplemented by the decision, announced in July, to put in hand in 1960 a further two or three stations, the lecturer referred to that period as one in which the main consideration was the restriction to 45 million tons of the yearly demand for coal by the Central Electricity Authority. In the present year the amount would be rather more than 45 million tons out of a total of 220 million tons mined. In 1965 the C.E.A. would require the equivalent of nearly 70 million tons of coal, of which 6 million would be furnished by atomic energy and nearly 20 million by oil. By 1975 the increased demands for electricity, which would otherwise take 100 million tons of coal out of 250 million tons mined, would be met by adding 3,000 MW of atomic plant each year and only existing power stations would use coal and oil.

The atomic power stations with an aggregate capacity then of 10,000 MW would be run on base loads and their electrical output would replace that from 40 million tons of coal. After that date the demand for coal and oil for generating electricity would remain steady until existing coal-fired stations became obsolete and by 1985 it would dwindle.

Coal was a chemical raw material as well as a fuel, but since the national economy was based on power, that must have first claim on what was available, leaving little for desirable alternative uses. Electricity and industrial steam-raising even now claimed about one-third of all coal used in this country, i.e. most of the 100 million tons of small coal raised. The coming of atomic energy would liberate coal for other purposes. Smokeless fuel for homes might in time reach 10 to 15 million tons more and processed metallurgical coke was required for meeting the expanding need for high quality coke in the iron and steel industry.

Within the next ten years more coal products should progressively be used in the chemical industry, so as to get more chemical wealth out of the gases in the coal and then out of the coal itself. For example there would be a shortage of the by-product naphthalene and new processes could increase the yield of phenols for making plastics and new fibres. To-day artificial fibres accounted for 5 to 10 per cent of the world's production but in ten to twenty years the proportion was expected to rise to 40 per cent.

Consumption of fuel oil in replacement of coal in this country was expected to increase by the equivalent of 5 million tons of coal in each of the next five years. Reserves of oil in the United States would probably fall during the 1960's and its cost would probably have risen to that of oil produced from coal; in Britain that might happen within twenty years. The making of oil from coal, therefore, provided a further subject for immediate research and pilot development. In South Africa, where uranium mining was being enlarged many times, a major plant had been put in hand to make both motor spirit and black oil from native coal. The implication of the foregoing was that the survival of coal mining as an industry depended upon its change-over within the next thirty years from a mainly extractive industry to a processing industry.

# Transistor Digital Fast Multiplier

IN a paper presented before the Institution of Electrical Engineers on 9th November, Dr. G. B. B. Chaplin (Atomic Energy Research Establishment) and Messrs. R. E. Hayes and A. R. Owens (Manchester University) described the construction of a digital fast multiplier using transistors throughout. The short-term collective reliability of transistors shown in a more complex apparatus than that in which they had previously been employed, together with their versatility and adequate frequency response, would justify their continued manufacture, the authors considered. Moreover, their use would facilitate the construction and maintenance of computer circuits.

Out of a total of 84 unselected point-contact transistors, 12 junction transistors and 568 crystal diodes, only three point-contact units failed in seven months of daily operation. The total power consumption was 50 W. Operating at a basic frequency of 125 kc/s, the multiplier computed the product of 32-digit serial numbers in about 4 millisec, a novel feature being the taking of the digits in pairs instead of singly. The multiplier was in three parts: the generator of powerful clock waveforms, generated by valves, which allowed the transistors to be operated well below their maximum power rating, resulting in low failure rate; the arithmetic unit; and the storage system (comprising magnetostrictive delay lines) the amplifiers associated with which were the junction units mentioned above.

# LETTERS TO THE EDITOR

*Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.*

## Fair Trading

THE shyness which seems to have overcome manufacturers and wholesalers concerning my recent letter on this subject (*Electrical Review*, 14th October) reminds me of the legal phrase " mute of malice." If, therefore, you will kindly extend to me the further use of your valuable publication, I would like to submit another aspect of the very great harm which is being done by irresponsibility in employing the principles laid down in the Fair Trading Policy. I refer to labour.

In these days of much greater use of electricity in every type of industrial and commercial activity, an extremely small business can easily give employment to a " journeyman electrician," and more and more are doing it, thereby qualifying for " recognized user " discounts. Whether the journeyman electrician keeps his job for very long, or whether the services of an electrical contractor are needed in addition, has, in fact, no effect on the discount privileges established by this absurd qualification.

But the real damage is caused to contractors when electricians whom they have trained—at no small cost and effort—are offered jobs by the contractors' customers, because, by so doing, those who have no stake in the electrical industry know that they can get discounts under the so-called Fair Trading Policy. Good electricians will not leave good employers, of course, without good reasons; but these can so easily be provided in terms of higher wages and other attractions where only one such worker is concerned in a factory, and where wage structure agreements such as exist in the National Federated Electrical Association do not apply.

In this way contractors are losing valuable men, and the lifeblood of their businesses; and the responsibility lies in the selfish use of an out-of-date policy—out-of-date in so far that one " journeyman electrician " qualifies. It should be not fewer than three, and even then manufacturers and wholesalers should be willing to operate the qualification under a formal declaration, or at least be honest enough to say why such a procedure is not acceptable to them.

*London, E.C.4.* J. MORTIMER HAWKINS,
*Managing Director,*
Mortimer, Gall & Co., Ltd.

## Electric Cookers

I THINK that possibly the fish in this case are not carp but red herring. The normal hob has one radiant plate with " Simmerstat " control, possibly one solid plate with three-way control and one awkward sized combined affair with three-heat control. Presumably, it is recognized that any other arrangement as standard would make the equipment too costly.

As for design, I should hesitate to say that either gas or electricity has copied the other; I expect that it is more true to say that both, following modern trends, have arrived at much the same point, along with the manufacturers of other domestic apparatus. At any rate, both gas and electricity appear to have evolved some form of eye level cookery at much the same time, and I have not yet seen the electric cooker from which the attractive cantilever hob was copied.

With nearly all of the cookers in a showroom that I visited the grill reflector was a raw-edged unfinished piece of plate; a number had rough edges on the front of the oven shell; most had very light hinges and latches.

At the gas showroom that I visited immediately afterwards attention had been paid to details of finish and also the enamelling appeared to me to be better, and prices were lower. In fact, for the price of one of the cookers that give Mr. Gamlen joy I could get a gas cooker that would very nearly do for two families.

I know that gas blows out, I know that it consumes oxygen and I know other disadvantages, but would it not be better to concede the faults of electric cookers, and set about getting them removed, than to continue pretending that they do not exist?

*Teddington, Middlesex.* F. W. JORDAN.

## Advanced Steam Conditions

MAY I draw your attention to a statement in your issue of 14th October, under " Generation and Development," page 779. In your description of High Marnham power station at the end of the first paragraph you state that " hitherto the most advanced conditions have been at Drakelow (1,500 lb/sq in and 1,050 deg F) also on the Trent."

In Stourport " B " power station No. 2 set was commissioned on 22nd July, 1954, the conditions of which are 1,550 lb/sq in and 1,050 deg F and this has been in more or less continuous operation since that date.

*Stourport-on-Severn.* G. E. C. ATTWOOD,
*Station Superintendent,*
Stourport " A " and " B " Generating Stations.

# E.R.A. Reports

AMONG the research reports which have been issued recently by the British Electrical and Allied Industries Research Association, report ref. Q/T123, " Design of High-Voltage Stress-Controlled Condenser-Type Bushings and Capacitors," by S. Silbermann, M.I.E.E. (price 30s) deals with the development of a general theory of the design of stress-controlled condenser-insulators, such as condenser-bushings and high-voltage capacitors, and with its application for practical purposes. The theoretical treatment in the appendix gives for the first time a mathematical derivation of the formulæ governing such designs in general and particular; this part may be omitted by readers who are not especially interested in such treatments. The main part of the report shows the application of the formulæ to the practical design and the calculation of the main dimensions and of the conducting layers in condenser bushings and high-voltage capacitors.

In report ref. L/T316, " Polarization of Dielectrics by Slow Particles III," by H. Pelzer (price 7s 6d) an expression for the dissipated energy, taking into account electronic as well as ionic polarizability, is derived from an expression due to Fröhlich and Platzman by a short method, made possible by a delta function relation of Gross and Pelzer. The expression for electric energy and other relations are derived phenomenologically from the dispersion law for the permittivity. Based on this an outline for a correct calculation of the energy carried along with the particle, to replace that of report ref. L/T184, is briefly indicated, but not carried out.

# INDUSTRIAL NEWS

## "Collusive Tendering"

The Board of Trade has announced the terms of reference of the Monopolies and Restrictive Practices Commission's inquiry into common prices and collusive tendering.

The Commission will examine the general effect on the public interest of agreements and arrangements among suppliers which restrict or limit competition in the prices at which they supply, offer to supply or tender to supply goods in the United Kingdom. It will also cover agreements and arrangements relating to the prices or charges for the application of a process to goods. Agreements relating to practices considered in the recent Report (Cmd. 9504) of the Monopolies Commission on collective discrimination, including collective resale price maintenance, are excluded. Individual resale price maintenance agreements are also excluded.

Evidence can be sent to the Secretary, Monopolies and Restrictive Practices Commission, 8, Cornwall Terrace, Regent's Park, London, N.W.1.

## Extensions for the Electrical Apparatus Co.

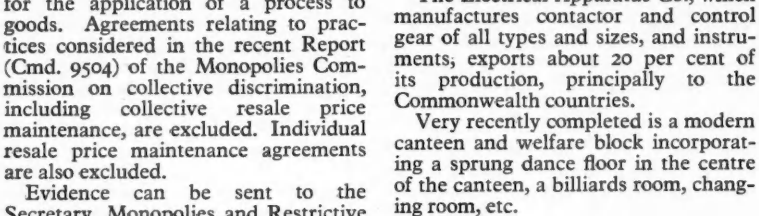
Recently we visited the factory of the Electrical Apparatus Co., Ltd., near St. Albans, and saw the 12,000 sq ft extension which has been carried out with the object of extending the test facilities for flameproof and large industrial control gear and to give a greater area for manufacturing the larger class of gear built to customers' requirements. The latter part occupies half of the extension and has enabled production to be expanded and quicker deliveries to be offered.

The original factory of the company at St. Albans was occupied by them in 1938 and had an area prior to the extensions of 63,000 sq ft. About 750 people are employed all told in these works.

The extensions were put into service last year and have an unusual feature in that an underground storage area was incorporated at the time of building. This has proved a very useful adjunct and permits speedy and convenient access to stores. Use is also made of this basement below the factory floor to house the motor generator sets associated with the control gear testing facilities provided.

The Electrical Apparatus Co., which manufactures contactor and control gear of all types and sizes, and instruments, exports about 20 per cent of its production, principally to the Commonwealth countries.

Very recently completed is a modern canteen and welfare block incorporating a sprung dance floor in the centre of the canteen, a billiards room, changing room, etc.



*Two views of the extensions at the E.A.C. works. The large control gear assembly bay can be seen in the right-hand picture*

## Electricity Supply Wages

A claim for a substantial increase in wages for the 123,000 manual workers in the electricity supply industry is being submitted to the National Joint Industrial Council on 17th November. Last January the Boards' side agreed to a general increase for all adult manual workers of 3d per hour, with an additional ½d and 1d for certain specified grades, on the understanding that rates remained stabilized for twelve months. Mr. Frank Foulkes, president of the Electrical Trades Union, will state the case on behalf of the unions.

## Electrical Contracting Wages

Following on the refusal of the National Federated Electrical Association to agree to a claim for a further wage increase, first submitted last June, there is to be a joint reference to the Ministry of Labour, requesting that the claim be referred to the Industrial Disputes Tribunal. Provision for arbitration on a joint reference was made in the settlement of last March, which increased skilled rates in the industry by 3d per hour.

## Engineering Unions' Claim

The claim by the engineering trade unions for an increase in the wages of their members, foreshadowed some time ago, was presented to the Engineering and Allied Employers' National Federation on 3rd November by Mr. R. Openshaw, president of the Amalgamated Engineering Union. The demand was for a "substantial" increase. No specific figure was mentioned but a rise of about 10 per cent in existing rates has been mentioned. Mr. Openshaw told Sir Percy Mills, chairman of the Employers' Federation, at the meeting that the unions also wished to raise the subjects of pension schemes, payment for overtime for night shifts preceding public holidays and joint consultation upon "redundancy."

Sir Percy Mills replied that the wage claim and the other points put forward would be referred to the Federation's branches for their consideration.

## Committee on Automation

In view of the widespread interest aroused by the Margate Conference of the Institution of Production Engineers on "The Automatic Factory—What Does It Mean?" and the many

problems which inevitably arise with the introduction of automatic control, it was decided at a recent meeting of the Institution's Council to set up a special committee to investigate the full implications of automation. The chairman of the committee will be Mr. A. F. Kelley, B.Sc., A.M.I.Mech.E., M.I.Prod.E., A.M.I.C.E., director and general manager (manufacturing), Aero Engines Division, Rolls-Royce, Ltd.

Other members of the committee are Sir Leonard Lord, K.B.E., president of the Institution; Mr. G. R. Pryor, chairman of Council; Mr. H. G. Gregory, vice-chairman; Mr. E. W. Hancock, M.B.E., director and general manager, Humber, Ltd.; Sir Walter Puckey, immediate past-president of the Institution; Mr. B. H. Dyson, general works manager, Hoover, Ltd.; the Earl of Halsbury, managing director, National Research Development Corporation; Mr. M. Seaman, director and general manager, British Oxygen Engineering, Ltd.; Mr. R. Telford, general works manager, Marconi's Wireless Telegraph Co., Ltd.; and Mr. F. G. Woollard, M.B.E.

The committee will study the implications of automation in the broadest sense, and will pay particular attention to the effect of automation on the human being and on human relations in industry and in society.

## Buchanan & Curwen Jubilee

Buchanan & Curwen, Ltd., commenced its electrical installation business in 1895 at Bristol and London. The Leatherhead branch was opened in 1907 and the Dorking branch in 1948. To-day, sixty years on, it has an organization which covers every phase of the electrical contracting industry and its kindred trades of refrigeration, radio and television, and from its Leatherhead premises at North Street and Fairfield Works it provides a complete electrical service. The Fairfield Works are equipped to deal with repairs of all kinds. There are separate workshops for the repair and maintenance of electrical food machinery, domestic appliances, refrigerators and deep freeze units. In the past two years the radio and television workshop has twice been extended to keep pace with modern requirements. A fleet of vans is maintained to give prompt service.

## Sound Reproducing Equipment Display

The Marconi International Marine Communication Co., Ltd., showed us last week at Marconi House, Strand, a display of "Mimco" sound reproducing equipment from their Special Products Division. Exhibits included everything required for sound reproduction on ship or shore, including a central control for a medium sized installation feeding up to 60 loudspeakers, a smaller receiver for use with up to ten loudspeakers, the "Pantenna" communal aerial system

*Marine sound reproducing equipment on display at Marconi House*

enabling up to eighty individual receivers to be fed from one aerial, the "Jericho" power megaphone and a variety of microphones, loudspeakers, loudhailers, etc. Also on show was a working installation of the "Quo Vadis" radar system for small ships described elsewhere in this issue.

## Mine Winders for the N.C.B.

An order valued at over £250,000 has been obtained by the British Thomson-Houston Co., Ltd., from the National Coal Board (N.E. Division, No. 2 Area) for two automatically controlled, tower mounted, electrically driven 4-rope friction winders for Brodsworth Colliery in Yorkshire. These winders are required in connection with a large reconstruction scheme at the colliery and will eventually replace the existing steam winders now operating in Nos. 1 and 2 shafts.

Each winder will be of the Ward-Leonard type, twin-motor driven, having a total driving horsepower of 2,700, and each equipment will consist of two d.c. motors, rated at 1,350 h.p. running at 600 r.p.m. The drum for each winder will be 12ft in diameter and arranged to accommodate four $1\frac{7}{16}$in diameter winding ropes in parallel. The d.c. motors, working in tandem, will drive the drum through a set of high-precision reduction gears specially designed to cater for any deflections likely to be associated with tower mounted winders. Each pinion will drive on to a common spurwheel, which is coupled to the drum shaft through a forged torsion or quill shaft and a patent B.T.H.-Metalastik low-speed coupling. The gear ratio is approximately 10: 1.

In the upcast shaft, winding will be accomplished by a skip and counterweight arrangement, the net load of coal per skip being 20 tons, the winder having an output of 360 tons per hour. The downcast shaft will accommodate a cage and counterweight, the former having two decks and on each deck there will be two 3-ton mine cars, giving an output of 250 tons per hour. The motor-generator sets for the two winders will be in the building interconnecting the two shafts. The winder will be automatically controlled by push buttons and interlocks and the control system will be of the closed-loop type with amplidyne exciters.

The B.T.H. Co. will be the main contractors for the winder installation, including the electrical portions and the main reduction gears. The subcontract for the mechanical portions has been placed by the B.T.H. Co. with Markham & Co., Ltd., Chesterfield. It is expected that both equipments will be installed during 1958.

## Colliery Winder for Scotland

The General Electric Co., Ltd., has received an order, to the value of approximately £93,000, for a fully-automatic, Ward-Leonard control, 4-rope friction winder to be installed at Seafield Colliery, East Fife Area, National Coal Board. The winder will serve the No. 1 shaft at this colliery and is designed to raise a coal load of 15 tons per wind in skips, from a depth of 1,930ft. This will give an output of 615 tons per hour R.O.M. coal. The 10ft diameter friction drum will have a speed of 59·45 r.p.m. and carry four $1\frac{1}{4}$in diameter locked coil ropes. Twin d.c. motors of 1,350 h.p., to be built at the company's Witton Works, will drive the drum through single-reduction gearing. They will be supplied from a Ward-Leonard set driven by a 2,300 h.p. synchronous induction motor. The G.E.C. system of closed loop speed control will be used, operating through high-response control exciters providing overriding torque limitation.

## Electricity in Building

A conference and exhibition on "Electricity in Building," specially arranged by the North Western Electricity Board for builders, architects, decorators, plumbers and others in the north-west, was held at Bolton Town Hall from 25th to 27th October.

The conference, the first of its kind to be held in the Board's area, was attended by representatives of concerns and local authorities from the major part of the Lancashire industrial area. Mr. A. L. Osborne, architectural adviser, E.D.A., spoke on "Electricity

in Housing Improvements and Repairs," and Mr. P. Honey (E.D.A.) showed how "Adequate Wiring Helps to Sell Houses." Mr. A. F. S. Wright (Gauldie, Hardie, Wright & Needham, chartered architects, Dundee) dealt with the design, installation and running costs of electric floor warming.

Chairmen at the various sessions included Mr. K. M. Baxter (Bolton borough architect); Mr. F. Draper (senior vice-president, Bolton and Farnworth Building Trades Employers' Association); Mr. H. M. Harrison (past-president, Manchester Branch of the E.C.A.); Mr. R. M. McNaught (vice-president, Manchester Society of Architects); and Mr. N. F. Curwood (president, Bolton Branch, Master Painters' and Decorators' Association). The exhibition, by means of set-pieces and apparatus, illustrated the application of electricity to building, both in the planning and later stages.

## B.T.H. Overseas Association

We regret that the caption to the picture which accompanied the note on the annual dinner of the B.T.H. Overseas Association, published in our last issue, was incorrect. Lord Bailleau was on the right of the picture and not in the centre as stated. The gentleman in the centre was Mr. H. Dreghorn, general superintendent, B.T.H. Rugby Works.

## The Story of Bruce Peebles

To mark the fiftieth anniversary of the erection of their East Pilton Works, Edinburgh, and the 88th anniversary of the establishment of the company, Bruce Peebles & Co., Ltd., have issued a book entitled "The Story of Bruce Peebles, 1866-1954," in which is given the history of the company from its foundation by David Bruce Peebles in 1866 to manufacture gas appliances, to its present position of one of the leading manufacturers in the country of heavy electrical equipment. After relating some of the work carried out in the early days, with illustrations of early equipment, the book describes the development of the East Pilton works and covers the rotating electrical machinery department, and the transformer, rectifier and welding departments. The book is well produced with profuse illustrations, many of which are in colour.

## Electrical "Self-Service" Stores

On Tuesday last new premises were opened by the Sloan Electrical Co., Ltd., at 28, River Street, Truro. The opening of this branch is of more than usual interest as it will be a "self-service" store, which it is believed is the first in the country opened by an electrical wholesaler. A multiplicity of electrical equipment and accessories have to be carried by an electrical wholesaler and the arrangement of the store, therefore, to enable customers to quickly find what they require, entailed considerable planning.

The company's catalogue has been taken as a natural index and the store has been laid out in catalogue order. Bins are labelled and a staff is available to assist the customer or to serve him in the conventional manner if he so desires. Many of the items in the store are bulky and heavy. On the ground floor, therefore, the customer is provided with a trolley on entering the store. Having obtained his requirements, the goods are booked out in the usual way and then transferred to the customer's vehicle. On the upper floors, the goods are wheeled to the goods lift which transfers them to the invoicing desk on the ground floor. The company has its own vehicles for customers who prefer to have their goods delivered.

The entrance to the store is through the showroom where appliances and lighting fittings are displayed, not only for the use of the contractor-retailer, but also for his customers, for which purpose the customary introductory vouchers are provided. To the rear of the showroom is the manager's office, and, behind that, the general office.

By this self-service method, customers may inspect goods and make comparisons with replacements or alternatives they require. The company also hopes that it will relieve retailers of the necessity of carrying large stocks.

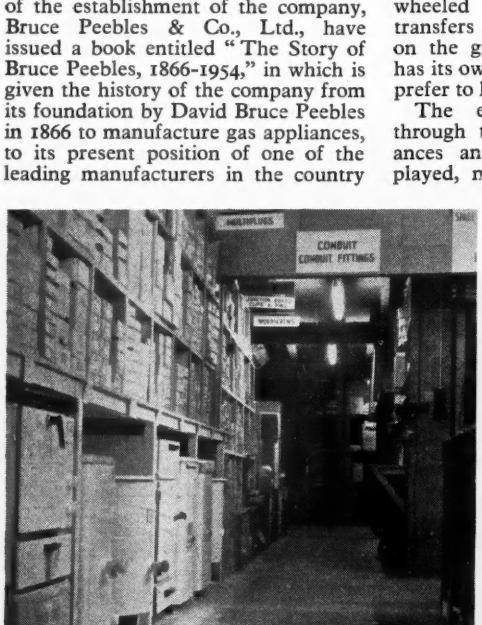
## Mechanical Handling Equipment on Tour

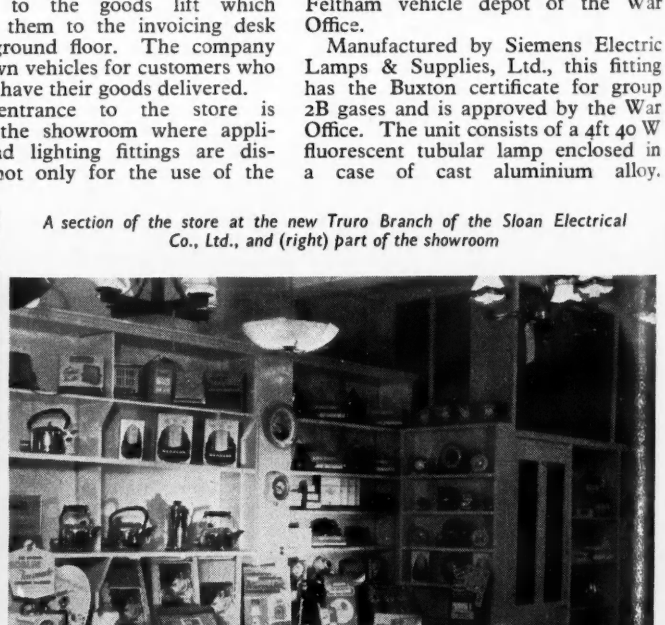
To demonstrate to business executives the savings in time, space, and manpower that can be obtained by using their range of fork trucks, tractors, pallet trucks, etc., powered either by batteries or diesel engines, Lansing Bagnall, Ltd., have chartered a special train from British Railways to tour the country. The five main coaches of the train contain examples of the company's equipment, arranged for easy demonstration at the stopping places. Another coach serves as a cinema in which films can be shown to illustrate the trucks at work in a variety of factories. The cities being visited in the period from 4th November to 6th December are Bristol, Cardiff, Liverpool, Manchester, Glasgow, Newcastle, Leeds, Hull, Sheffield, Nottingham and Birmingham.

## Inspection Pit Lighting

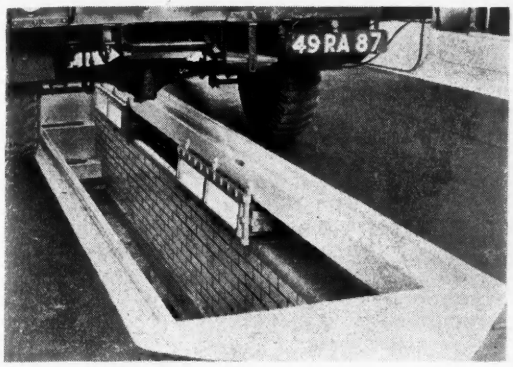
A flameproof fluorescent lighting installation for vehicle inspection pits has recently been completed at the Feltham vehicle depot of the War Office.

Manufactured by Siemens Electric Lamps & Supplies, Ltd., this fitting has the Buxton certificate for group 2B gases and is approved by the War Office. The unit consists of a 4ft 40 W fluorescent tubular lamp enclosed in a case of cast aluminium alloy.



*A section of the store at the new Truro Branch of the Sloan Electrical Co., Ltd., and (right) part of the showroom*




*A typical Siemens fluorescent lighting fitting installed in an inspection pit at the Feltham vehicle depot*

It is fitted with a front cover and a recessed window of ⅜in armour-plate glass retained by a frame of cadmium plated mild steel, and is sealed with a special gas-proof cement.

Designed and constructed to conform with B.S. 229 and B.S. 889, the fitting has terminal boxes at each end which are separated from the main compartment by flameproof bulkheads. To prevent glare the top section of the "Birmabright" reflector is finished in white lacquer and the lower anodized clear. Reflector mounting and shape ensure a throw of light upwards.

Sixteen fittings have been installed at Feltham and over 150 are to be installed at similar War Office depots.

## Overseas Electrical Trade

In our review of British electrical exports in September (*Electrical Review*, 28th October, page 853) the figures for rubber insulated and thermoplastic insulated cables in Table I were inadvertently transposed. They should read as follows:—

| | Sept., 1955 | Nine months 1954 | Nine months 1955 |
|---|---|---|---|
| | £ | £ | £ |
| Rubber insul. | 379,273 | 3,588,864 | 4,127,883 |
| Thermoplastic | 82,157 | — | 740,156 |

## Works Visit

Japanese trade unionists recently visited the works of F. Perkins, Ltd., at Peterborough. They included Mr. Masahichi Motoi, vice-president (Japan Federation of Trade Unions), Mr. Ushitaro Okamoto (chairman, Tokyo Metropolitan Workers' Union) and Mr. Genjiro Sumino (chairman, Osaka Federation of Metal Workers' Union). After luncheon the visitors made a tour of the works and the company's instruction school.

## Fire at Indian Industries Fair

Many thousands of pounds worth of telecommunication equipment being exhibited at the Indian Industries Fair, New Delhi, by the Automatic Telephone & Electric Co., Ltd., was among property lost when fire completely destroyed one of the large trade pavilions. The outbreak is understood to have started in a part of the building used by Rumanian exhibitors, and quickly spread to other stands. The main British pavilion, some distance away, was unaffected. The Automatic Telephone & Electric Co.'s stand, which demonstrated under working conditions the latest developments in telecommunication technique, was one of the largest individual British exhibits at the Fair. It occupied some 4,000 sq ft and cost an estimated £100,000 to produce. Exhibits included the latest types of multi-channel telephone carrier equipment—12-channel, 60-channel, and coaxial—designed to show the behind-the-scenes telephone equipment, v.h.f. radio telephones, a magnetic drum, and the full range of A.T.M. mine signalling, private automatic exchange and inter-office telephone equipment.

## American Contract Decision Delayed

The United States Department of the Interior has deferred a decision upon tenders received for substation equipment for undertakings in Idaho, Minnesota and South Dakota. *Reuter* reports that for transformers for the Minidoka project in Idaho the English Electric Co. put in an offer of about £36,000 against the lowest American bid of £38,000.

Mr. F. Aandahl, Assistant Secretary of the Interior, stated last week that the delay in coming to a decision on the contracts was because there were doubts whether some of the American tenderers were entitled to the full protection of the "Buy American" Act, particularly on the point of the extent of unemployment in the Pittsburgh area.

Earlier this year an offer by the English Electric Co. was passed over in favour of a tender by an American concern whose works were in Pittsburgh, then said to be a "surplus labour area."

## Transmitters for Iraq

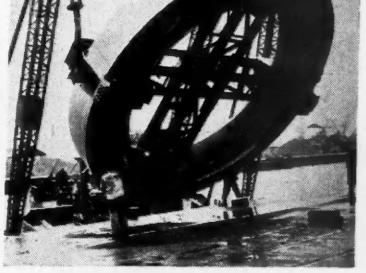
An order has been received by Marconi's Wireless Telegraph Co., Ltd., from the Iraq Posts and Telegraphs Department, for a complete new high-power broadcasting station at Abu Ghraib, near Baghdad. Four 100 kW air-cooled transmitters are included in the order, together with programme input equipment, automatic monitoring equipment and a four-channel super high frequency music link for use between the Baghdad studios and the transmitting station. A 165-metre half-wave mast radiator and an h.f. aerial system are being supplied. Marconi's are also responsible for supplying and installing the equipment and the construction of the buildings for the station.

## Liverpool Safety Exhibition

Lunch-hour film shows were staged during a recent National Industrial Safety Week Exhibition held at the Liverpool works of the Automatic Telephone & Electric, Co., Ltd. More than 2,500 saw the exhibition, which was divided into six sections—electrical safeguards; first-aid and fire-fighting equipment; eye protection; protective clothing; machine guarding and foot protection. It was organized by the company's Accident Prevention Advisory Committee. In addition to the many exhibits in the cinema, the company ran a safety slogan competition for cash prizes.

## Large Electro-Magnet

In connection with very high power electron accelerator equipment which is to be installed at the European Nuclear Research Laboratory at Geneva two large electro-magnets



*Large electro-magnet being loaded into a barge at Liege for transport to Switzerland*

have been ordered. The accompanying illustration shows one of these being loaded into a barge at Liege, Belgium, from where it is to be transported via the Canal Albert, the Schelde and the Rhine to Basle, Switzerland. The magnet was assembled at Liege and it is described as a 55 ton electro-magnet.

## Trade Announcements

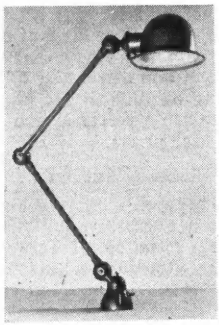
**Davey, Paxman & Co., Ltd.,** announce that they have concluded an agreement with the Breda Motori S.p.A. of Milan, Italy, under which the Breda Motori Co. will manufacture and sell in Italy the Paxman type YL engine (9¾in bore × 10½in stroke).

**The British Driver-Harris Co., Ltd.,** announces that it can now supply thermostatic bi-metal for a wide range of industrial and domestic applications. A new Bi-metal Section has been established to deal with all aspects of research, production and marketing. This follows a lengthy period of research by the company in collaboration with the W. M. Chase Co. of America.

# NEW ELECTRICAL EQUIPMENT

## Industrial Lighting Unit

The "Infini-Angle" lighting unit available from the BRITISH CENTRAL ELECTRICAL CO., LTD., 6 & 8, Rosebery Avenue, London, E.C.1, is designed



*British Central Electrical Co.'s "Infini-Angle" lighting unit*

for use in the workshop, inspection department or laboratory. It is assembled with slip-ring connections at all joints, allowing complete rotation.

The components, finished in "vespa" green, comprise one or more arms, according to the length required, reflector and lampholder. Clear, opal or coloured "Perspex" covers can be supplied. The wiring between slip-ring connections is internal and permanent and the slip-rings are tested up to 2 kW at 230 V.

The standard unit, with one arm and b.c. lampholder, is priced at £3 15s and two-arm models are £4 11s 6d. They are also available with e.s. lampholders.

## Direct-on Starter

The ELECTRICAL APPARATUS CO., LTD., of St. Albans, Herts, has produced a new direct-on starter, the "Autette," designed for the control of single-, two- and three-phase fractional horse-power motors up to and including ½ h.p. at 200/450 V, in those cases where a no-volt release is not necessary.

It is built to B.S. 587/40 and is a highly standardized unit, incorporating the E.A.C. patent overload and single-phasing preventer unit. The "Autette" thus makes available for small motors a control unit giving triple-pole overload protection and protection against single-phasing at low cost. Briefly, the starter constitutes a triple-pole switch closed and opened mechanically by means of self-contained "on" and "off" push-buttons. In the event of overload or single-phasing, the switch is automatically tripped, thus disconnecting the motor. The "Autette" is not suitable for remote control.

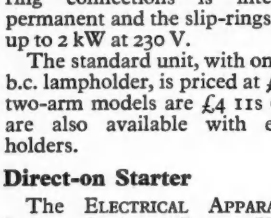
## Flameproof Gate-end Panel

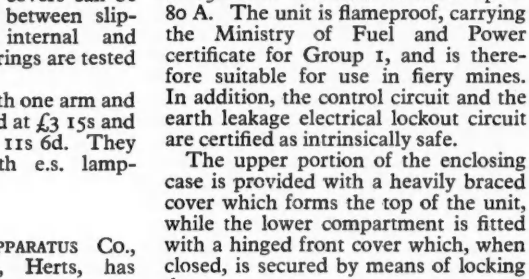
A new automatic gate-end panel is now in full production at the Witton Engineering Works of the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. This panel, designated type F.M.U.3, is primarily intended for use with motors driving coal cutters, loaders and conveyors working at the coal face, being designed for the control of squirrel cage motors at voltages of from 400 to 650 with full load currents up to 80 A. The unit is flameproof, carrying the Ministry of Fuel and Power certificate for Group 1, and is therefore suitable for use in fiery mines. In addition, the control circuit and the earth leakage electrical lockout circuit are certified as intrinsically safe.

The upper portion of the enclosing case is provided with a heavily braced cover which forms the top of the unit, while the lower compartment is fitted with a hinged front cover which, when closed, is secured by means of locking dogs.

The top compartment houses the 300 A busbars and a triple-pole reversing isolator and the lower compartment houses a withdrawable chassis, on which are mounted the triple-pole main contactor, two overcurrent relays, the core-balance and voltage transformers and the protective relays and fuses. The chassis also carries a combined test and reset switch, a local control switch, and a sequence selector switch with an integral emergency-stop button.

*E.A.C. "Autette" starter*

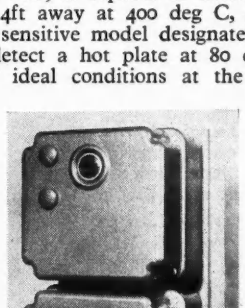


*G.E.C. automatic gate-end panel*

## Infra-Red Relays

Recent investigations by research engineers of the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, have led to a new patented design of electronic relay being introduced which uses a lead sulphide photo-conductive cell as the sensitive element. The equipment is operated by the invisible infra-red radiation from a hot body (even at black heat) and the built-in relay is capable of controlling an external electric circuit carrying up to 1 A at 440 V a.c. Unlike a photo-electric relay equipment, no separate light source is necessary. The two equipments now available are suitable for service under the most arduous conditions. One of them, known as model IR2, is capable of detecting a body 4ft away at 400 deg C, and a more sensitive model designated IR3 will detect a hot plate at 80 deg C under ideal conditions at the same



*B.T.H. Type IR3 infra-red relay equipment*

distance. Features of particular interest are the high speed of response and high sensitivity.

It is essential to keep the cell reasonably cool for efficient operation and to maintain it at a sufficiently low temperature (about 60 deg C) it is fitted in a specially-designed water-cooled housing. By this means, adequate cooling is achieved even when there is no alternative but to mount the detecting head in close proximity to very hot bodies such as white-hot billets of steel. With the IR3 the water-cooled head differs in that a motor-driven disc is incorporated to interrupt the radiation falling on the cell thus feeding an a.c. signal to the electronic amplifier.

## Electric Hoists

The TAYLOR STOKER CO., LTD., 189/191, Drummond Street, London,

"Munck" model 221 hoist

N.W.1, announces the introduction to the British market of a new range of electric hoists. These "Munck" hoists cover loads from 2½ cwt to 10 tons, with a variety of lift weights and speeds.

The hoist is of all-steel construction, enclosed in a steel housing, with the motor assembled inside the drum. The motor is of tapered-rotor construction and automatically engages or releases the brake which is coupled directly to one end of the motor shaft. The gearbox, brake and electrical contacts are all enclosed in the housing. All hoists are fitted with a rope guide which encircles the drum to ensure the rope winding correctly in the drum grooving and this also actuates, automatically, a limit switch to prevent overwinding and overlowering.

Every size of hoist can be supplied either for fixed mounting, or with a trolley carriage to suit standard I-beams, and all models can be provided with a micro-speed motor to give a creeping speed, in addition to the normal speed.

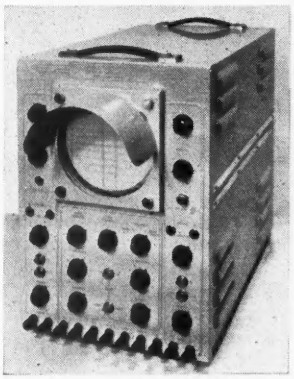
## Decorative Lighting

A new decoration light set is now available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. It is known as the "Osram" "Star and Candle" set, and comprises six coloured plastics stars and six coloured plastics candles, illuminated by 20 V 3 W lamps connected in series. The stars are illuminated from the inside by small clear lamps, and each candle is fitted with a coloured bulb which represents the candle flame. This new "Osram" set is supplied complete with two spare lamps, beads for fixing and a b.c. adaptor. The price, including purchase tax, is £2 0s 8d. The "Standard" set at £1 0s 8d, and the "Party Light" set, are being retained this season, together with the "Large Bulb" set which is now reduced in price from £1 19s 6d to £1 14s 6d (including purchase tax). A new publication in full colour, describing all four sets, is now available.

A new "Osram" coloured lamp set specially designed for outdoor use in all weathers is now available for supply voltages between 230 and 250 V. Each set consists of eight 15 W lamps, two red, two blue, two green and two yellow, with weatherproof s.e.s. lamp holders and is wired complete with 18ft of flexible. The flexible is fitted with a 5 A 2-pin plug at one end and a fully protected matching socket at the other end. The lamps are coloured internally and have a smooth, easily cleaned surface. For large installations, groups of 8 sets can be joined together to form total lengths of 144ft by means of the special weatherproof 5 A 2-pin plug and socket supplied with every set. The lamps are wired in parallel; thus should any lamp fail the remainder stay alight. The price is £2 4s 0d (including 4s purchase tax). Replacement lamps cost 2s 4d, plus 6d purchase tax.

## Oscilloscopes

Two new general purpose oscilloscopes have been developed lately by SOUTHERN INSTRUMENTS, LTD.,



M972 double beam oscilloscope

Camberley, Surrey, incorporating flat-faced 6in cathode-ray tubes by 20th Century Electronics, Ltd. The M972 is a dual gun type and the M974 a four gun type. The gun assemblies are entirely separate, enabling full use to be made of independent beam and plate controls without interaction.

Separate identical Y amplifiers for each beam make possible the direct comparison of waveforms and the gain of each Y amplifier is continuously variable from 80-1,500 over a bandwidth from d.c. to 100 kc/s. R.c. coupling can be provided by switch selection and there is a frequency compensated 10 : 1 input attenuator. The M972 has separate identical X amplifiers flat from d.c. to 50 kc/s ±1 dB with unbalanced input, and the M974 two X amplifiers with equalizing preset controls to give exact X axis alignment on all four beams.

The time base is continuously variable from 2 c/s to 30 kc/s and can be synchronized internally or from an external signal as low as 100 mV. In addition, provision is made for synchronization from contacts on a machine or vibratory device, and for beam triggering from the timing contacts on the company's "Universal" camera. Time marking by brightening or blanking pulses may be applied by Z axis modulation.

## Silver Solder Paint

In addition to their "Fryolux" solder paint introduced many years ago, FRY'S METAL FOUNDRIES, LTD., of Merton Abbey, London, S.W.19, have now developed F.E.F. silver solder paint for sweat soldering in the field of low temperature brazing.

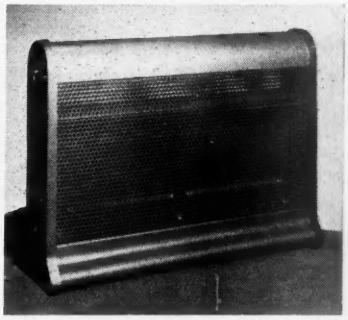
This is made from silver solder which is finely powdered and mixed with silver solder flux and gelling agent and combines all the essential features —low melting, good fluidity, joint strength and ability to join dissimilar metals. The grade of solder used in the paint is in full accordance with B.S. 1845, type 3, and has a melting range of 620-630 deg C, a tensile strength of 30 tons/sq in, an elongation of 35 per cent, a Brinell hardness of 131 and an electrical conductivity of 21 per cent I.A.C.S.

It is suitable for individual jobs or for mass production and the work can be carried out by unskilled labour, the paint being normally applied by stick or spatula. A variety of methods of heating can be employed, including spot torch, soldering oven, muffle furnace, electro gas, electrical resistance and high frequency induction. F.E.F. paint is supplied in small jars of 1 and 2 oz each or in tins of 4 and 8 oz.

## Electric Radiator

The new "Falco" No. 206 electric radiator, manufactured by the Falkirk Iron Co., Ltd., is now available from FALCO ELECTRICAL APPLIANCES, LTD., Audenshaw, Manchester. It is suitable for use in the hall, bedroom or nursery and the 1 kW loading can be reduced by means of a kick-switch fitted on the side panel. The dimensions are 18in high by 24in long by 6½in deep, and the finish is in either cream, green, gold or blue stoved enamel. The price is £5 19s 6d, plus £2 12s 5d purchase tax in the United Kingdom.

"Falco" No. 206 electric radiator



**WORLD ELECTRICAL MARKETS**

# *Highly-Developed Sweden*

By PHILIP L. LORRAINE (Ektorp, Sweden)

DURING 1954 Sweden's total output of electrical energy was 23,700 million kWh which made its *per capita* consumption of over 3,000 kWh the third highest, after Norway and Switzerland, in the world. In the towns and more populous localities electricity is now available to practically everybody, and in the rural areas 93 per cent of the homes have electricity. Altogether 98 per cent of all homes in Sweden are electrified, the world's highest figure. Of the 30,000 families which are now without the use of electricity very few (mainly those in the extreme outlying districts) will remain unserved in a few years' time as a result of the great strides which are being made in electrifying completely this 1,029-mile long country.

Power in Sweden is almost exclusively hydro-electric; at normal flow water power usually meets from 97 to 98 per cent of the total power requirements. The remainder is steam power obtained chiefly from industrial back-pressure installations and power supply undertakings. Even the island of Gotland which lacks water power resources is now supplied by an underwater high-voltage d.c. cable from the mainland 62 miles away.

In Sweden the State is responsible for 36 per cent of the total energy production, the municipal authorities for 6 per cent and private companies for the remaining 58 per cent. Most of the retail distribution is in the hands of the municipal bodies leaving the business of production and transmission mainly to the State and private power companies.

## Water Power Resources

The total resources of water power are estimated at about 150,000 million kWh per annum. With existing technical resources the economically exploitable power is at present estimated at about 60,000 million kWh. Improved constructional methods, however, and the newly developed technique of harnessing a large number of small waterfalls through one large plant should enable this figure to reach 80,000 million kWh per annum.

The rapid strides made in Sweden during the last two decades in the exploitation of hydro-electric power, which is now at more than three times its pre-war level, is due not only to the enormous wealth of the country's undeveloped resources but also to the skill and energy of Swedish engineers in carrying out the most ambitious projects and constructing the necessary tunnels, generating machinery, and transmission lines. The last in particular have aroused considerable interest throughout the engineering world. As about 85 per cent of the power is generated in the northern half of the country and five-sixths of the seven million inhabitants live in the southern half, long transmission lines are required to take the power to the main consuming areas. Swedish engineers have distinguished themselves by building the first transmission line in the world to operate at 380 kV, which connects Sweden's largest power station, Harspranget in Lappland, with Central Sweden. When this trunk system is finally completed in 1958 it will total 4,666 miles in length.

Many new stations are now being built along the big rivers in the north of Sweden. Three on the Indal River will be completed this year, and others will be ready in 1956 and 1957. An important milestone will be reached in 1959, when the Stornorrfors plant on the Ume River is scheduled for completion. Costing over £15 million it will be Sweden's as well as Europe's largest hydro-electric station with three generating sets of 130 MW each with a planned output of 2,200 million kWh per annum. In the 1960's the State Power Board will concentrate its energies on the Lule River where four more large power stations are being planned. Two of these will have the same capacity as Harspranget which is now equipped with three generating sets of 105 MW.

The extent to which these and other projects will be fully realized will depend partly on the degree of success with which many current difficulties are overcome. The natural obstacles to exploitation become more formidable as new and less accessible falls are tackled. There is a persistent shortage of qualified staff and there are from time to time delays in the delivery of materials and equipment.

Swedish power stations and distribution installations have, with very few exceptions, been planned and built by Swedish enterprise. State installations are designed throughout by the State Power Board, which also carries out the constructional work under its own administration. Certain of the large power undertakings also plan and build their own installations, in most cases assisted by firms of consulting engineers.

The Swedish electrical engineering industry is roughly divided into three main groups: one concerned with power technique, another with telecommunications and the third with domestic appliances, etc.

Exploitation of Sweden's abundant hydro-electric power resources has led to the development of an important electrical equipment industry. The chief manufacturer in this branch is Allmänna Svenska Elektriska A.B. (ASEA), a concern which was founded in 1883, has 29,000 employees on its pay-roll and is Sweden's largest industrial undertaking. A considerable portion of its output is machinery and equipment for the generation, transmission, and distribution of electric power. In Sweden, the large generators used in hydro-electric power stations have been, and are still being supplied exclusively by ASEA. Large-scale deliveries of hydro-electric power equipment have also been made to other countries.

The various subsidiaries of the ASEA concern are also engaged in the production of fans, air-conditioning and drying plant, electrical machines and transformers, copper cables and wire, drilling machines, cranes, electric traction equipment, gas turbines, compressors, refrigerating plants, electric cookers, electric pumps, welding machines, and electrodes.

In the telecommunications group the principal activities are the production of telephone and telegraph equipment, signalling, radar and other communication apparatus. Here Telefon A.B. L. M. Ericsson (with its subsidiaries) is the leading firm. It has also plants for the manufacture of telephone equipment in Denmark, Finland, Norway, France, Italy, the Netherlands, Spain, and the United

States, and it has selling organizations in most other countries of importance. This undertaking covers a wide field in telephone research. With one telephone for every three inhabitants the current level of Swedish output of telephone and telegraph apparatus is more than sufficient for domestic requirements and a considerable export trade has been built up, about half of the total production going to some fifty overseas markets.

## The Radio Industry

Other branches of the telecommunications industry in which Swedish manufacturers have gained a considerable reputation are domestic and commercial radio receiving apparatus, and v.h.f. telecommunication equipment, including equipment for police, fire, and ambulance services. Further important items are v.h.f.-d/f air beacons and other kinds of navigational aids, including echo sounders and gyro compasses. Radar for land, sea and air is for the most part manufactured under licence.

The production of commercial and domestic receiving apparatus is in the hands of a few large manufacturers who keep abreast of the times and produce items of high quality and performance. They are also catering to an increasing degree for the growing Swedish demand for component parts, and are well equipped to meet the future demand for television apparatus as soon as full-scale television transmissions begin.

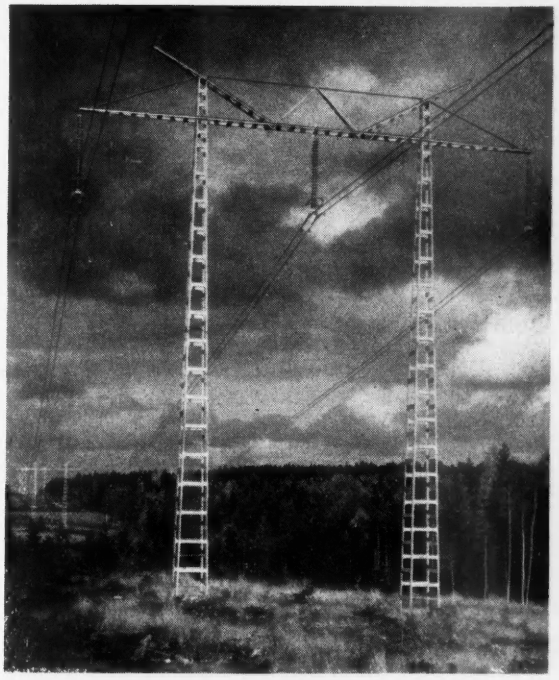
The market in Sweden for domestic radio receivers (the number of licence holders now totalling 2,390,525) and radio-gramophones is met almost entirely by local production. There is, however, a considerable demand for high quality components such as valves and valve holders; high tolerance resistors (composition and wire-wound); condensers (fixed air, ceramic, electrolytic, mica foil, paper, etc.); tuning condensers and coils; dust cores; volume controls; insulated wires, etc. Other items which may be of interest to importers are radio fuses, transformers, laminations, metal rectifiers, mounting strips, solder tags and flux-cored solder. Some Swedish radio manufacturers are now using miniature tubes exclusively in their radio receivers.

As the Swedes have proportionally the highest number of cars in the whole of Europe—which amounts to one for each ten inhabitants—car radio sets which preferably have three wave-bands find a ready sale. Although three-speed electric gramophone turntables with pick-up are made locally many are also imported. Imports of radio receivers and parts in 1953 amounted to 17,655,000 Swedish kronor (14·50 Swedish kronor equal £1 sterling) of which items worth Kr.8,574,000 came from the Netherlands, Kr.3,266,000 from Great Britain, and Kr.2,980,000 from Western Germany.

## Television Begins

In preparation for the full-scale transmission of television programmes expected very shortly Swedish radio manufacturers are producing prototype receivers which can be put into production at once. The Swedes are adopting the general European system of 625 lines. As in the case of radio receivers, although the Swedish radio industry is expected to supply the demand for TV receivers (possibly multi-channel type) a considerable demand should exist for valves and components, also flat picture tubes, 15-16in, and special items such as h.v. rectifiers and condensers, heavily insulated conductors (polyethylene), metallized paper, condensers, coaxial cable, focus coils and deflection yokes.

A fairly wide range of nautical instruments is made in Sweden, one of the largest manufacturers producing gyro-compasses, direction-finding apparatus, echo-sounding



*Part of the 380 kV line from Harspranget to Skane Province (1,500 km)*

*Machine hall of the Harspranget power station; the roof is about 180ft below the surface*

equipment, etc. The same company is also making blind-flying equipment for aircraft. Radar in all its various applications for land, sea and air has a very large potential market in Sweden, particularly taking into consideration Sweden's large and modern mercantile marine and civilian airlines, apart from its expanding air force and navy. Most United Kingdom firms specializing in radar navigational aids and equipment are well established, but it has been reported recently that a 3 cm navigational radar is being developed locally, as are " ship-shore " installations, much of the equipment for which is imported or manufactured under licence. Many Swedish cargo ships and fishing vessels are now fitted with radar for navigational and detection purposes.

## Railway Electrification

With 4,200 miles of its 10,000-mile railway system electrified Sweden has the biggest electrified railway network in the world, the longest electrified line being the 1,370 miles between Trelleborg and Narvik (in Norway). About 85 per cent of the total railway traffic is electrically operated at 16 kV single-phase a.c. 16⅔ c/s. With the exception of a few locomotives imported from West Germany almost all the electrical equipment used on the Swedish railway network as well as on the municipal electric tramway and trolley-bus services of Stockholm, Gothenburg, and Malmö—the three largest cities—is of Swedish manufacture.

In the general industrial field competition amongst domestic manufacturers for electrical plant, switchgear and cables is very keen. Nevertheless, among a wide range of imported electrical products which have found a market in Sweden may be mentioned generators and motors and parts, transformers, underground power cables and telephone cables (lead-covered and armoured, paper-insulated and p.v.c.-insulated), starting and regulating resistances, safety and excess voltage apparatus, certain h.v. switchgear, insulators, cable joint boxes, and unmounted accumulator battery parts. West German competition has increased considerably in this field during the last few years amounting in 1953 to almost half the total value of Kr.67,261,000 for generators alone.

A large part of the demand for commercial electrical equipment is met locally although here as well there is a fair market for many kinds of imported machines including electric pumps, compressors, drills, ventilating equipment, refrigerating equipment and parts, fluorescent lamps and ancillary equipment. There is a growing interest in X-ray equipment for use in industry but at present the demand is rather small.

The Swedish production of electro-medical and radiological apparatus (including X-ray apparatus) and parts amounted in 1953 to over 11,000 tons. There is demand for certain radiological equipment, diagnostic apparatus, dental apparatus, electro-therapy, massage, manicure, and pedicure machines. Special instruments are also imported such as encephalographs. Hearing aids and hearing aid components also enjoy relatively good sales, and the competition in this field is very keen among manufacturers chiefly from the United States, the Netherlands, Denmark, Germany and the United Kingdom. Although X-ray equipment and tubes of excellent quality are produced locally and also exported, a fair demand exists for certain imported X-ray equipment which the United States and Western Germany mostly supply. The introduction of a limited free public health scheme last year has stimulated the demand for medical equipment which is by no means fully satisfied.

**SWEDISH ELECTRICAL TRADE IN 1954**

| Class | Imports Kr. (000) | Exports Kr. (000) |
|---|---|---|
| Generators and motors | 58,039 | 60,055 |
| Fans, vacuum cleaners, floor polishers, washing and dish-washing machines | 41,580 | 39,443 |
| Stators, rotors | 7,814 | 2,516 |
| Galvanic elements | 4,405 | — |
| Accumulators | 3,113 | 18,285 |
| Lamps—carbon, mercury, car, cycle, etc. | 18,315 | 831 |
| Carbon, electrodes, etc. | 10,824 | 4,383 |
| Protective equipment, switches, etc. | 20,029 | 20,001 |
| Insulators | 1,612 | — |
| Cables—metal covered | 22,653 | 9,838 |
| other | 11,024 | — |
| Stoves, heaters, irons | 3,552 | 2,859 |
| Telegraph and telephone equipment | 2,233 | 100,436 |
| Radio receivers and electronic valves | 43,883 | 14,385 |
| X-ray tubes | 1,657 | 533 |
| Electro-medical and other apparatus, electro-technical | 75,680 | 51,328 |

1,000 Swedish kronor=£69 (approx.)

Many kinds of electronic products used in industry and the office are made in Sweden. Wire and tape recorders are produced by two Swedish manufacturers who find difficulty in competing in price with American equipment which is very popular, as is a recently introduced German product with plastic tape. Other imported products which have found a useful market are high-frequency heaters and electronic control equipment.

## Domestic Appliances

The market for domestic electrical appliances is large in view of the almost total electrification of the country but conditions are rather special and it should be remembered that many blocks of modern flats are equipped with locally produced cookers, hot cupboards for food, built-in refrigerators, and central heating. Most of these blocks of flats also have communal laundries with electric washing machines, centrifugal dryers, and ironing machines. In general, the local production of household electrical equipment is considerable and covers nearly the whole range of appliances used. In spite of strong competition, however, the United Kingdom has taken a big share of the market for washing machines, vacuum cleaners, fans and refrigerator parts (cabinets, condenser units, etc.). Among items of interest to importers may be mentioned also kitchen food mixers, thermostatically controlled irons, razors, clocks, coffee percolators and hair dryers.

Very stringent regulations are laid down regarding the standard of safety required in electrical fittings and apparatus, and imports of many types of equipment are not allowed until they have been tested and approved by the Swedish Bureau for Testing Electrical Equipment (SEMKO). Testing is obligatory for the following types of equipment, amongst others: radio receivers and certain types of amplifiers, rubber-insulated cables, conductors insulated with thermoplastic materials, certain heating appliances and some types of domestic appliances driven by electric motors. Approved equipment is provided with the Bureau's mark of approval consisting of an " S " of special shape inside a ring. There is also official price control of certain types of office machines, washing machines, dish-washing machines, refrigerators, vacuum cleaners, and electric shaving apparatus. The table gives some figures of electrical exports and imports for 1954.

## World Tunnelling Record

A NEW world tunnelling record has been established during tunnelling operations on the St. Fillans section of the North of Scotland Hydro-Electric Board's Breadalbane project in Perthshire. In seven working days (19th to 26th October) tunnelling crews of the Mitchell Construction Co. drove 557ft of 8ft 6in bed width through hard epidiorite rock. The previous world record was 551ft set up in the United States. Each member of the tunnelling crew (three teams each of thirteen men) is to receive a watch in recognition of this achievement. The consulting engineers are Sir Murdoch McDonald & Partners.

# World Electrical Exports

*British Progress, Foreign Competition and Future Trends*

By R. E. KAAN, Dipl.Ing.

GREAT BRITAIN'S second largest exporting industry, with exports amounting to £218 million in 1954, showed a 5·4 per cent increase for the first eight months of this year compared with the corresponding 1954 figure. This achievement was gained in face of increasing Continental competition, internal strikes and a deterioration in growth of electrical world trade (Figs. 1 and 2).

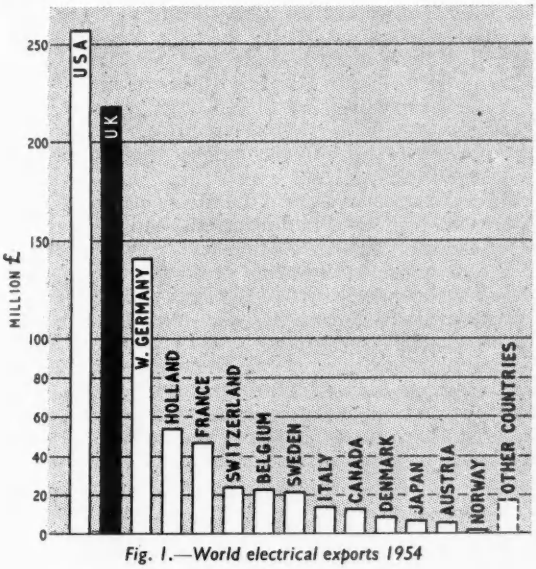



*Fig. 1.—World electrical exports 1954*

The importance of United Kingdom electrical exports in a buyers' market is stressed by the fact that her export ratio, compared with production, is higher than that of her main competitors, the United States and Western Germany. In spite of her export achievements Great Britain's share in world trade declined while that of Western Germany rose.

The bulk of United Kingdom electrical exports is directed to primary producing areas (mainly the sterling area countries within the Commonwealth) where the demand for their own products, and in consequence their income, has not lately kept up with the growth of world trade as a whole. Thus many of Britain's main customers have, not infrequently, had to impose import restrictions.

In order to make full use of the available production capacity the need for seizing new opportunities within Continental Europe and the Middle East cannot be overstressed.

The difficulties of exporting, even to traditional markets, were never greater than they are at present. Growing pressure of foreign competition, particularly from Western Germany, continues to be felt throughout the whole line of electrical products.

Though other Continental competitors succeeded in extending their exports considerably, WESTERN GERMANY, as in former years, reveals the most spectacular success, her electrical exports for the first eight months of this year being 20 per cent higher than last year's record (Fig. 3). (A detailed survey of Western Germany's electrical exports appeared in the *Electrical Review* of 9th September last.)

The world's fourth biggest exporter of electrical goods, HOLLAND, succeeded in increasing her exports by 20 per cent to £54 million in 1954. The products of the Philips concern account for the major part.

FRANCE'S electrical exports, mainly directed to her overseas possessions, amounted to £47·8 million. The SWISS electrical industry, in common with other Continental manufacturers, by self-subsidizing her exports, i.e. keeping home prices at such a level as to permit export price cuts, on many occasions booked orders for heavy plant and machinery, particularly where the labour content outweighed that of materials. As in the case of Western Germany, "made-to-measure" equipment accounted largely for Swiss successes. While ITALIAN electrical exports remained static last year at £13·6 million, SWEDEN managed to increase hers by 3 per cent to £21·2 million. In both cases exports of heavy electrical plant and machinery accounted for the main share.

BELGIUM, bordering on full employment, mainly because of the efforts of the Ateliers de Constructions Electriques de Charleroi, managed to increase her electrical exports, particularly in transformers. Out of a total of transformer exports valued at £2·1 million, the Belgian Congo took £0·6 million, France £0·4 million, Australia £0·3 million, and India £0·12 million. Nearly £400,000 worth of switchgear and switchboards were shipped to Australia

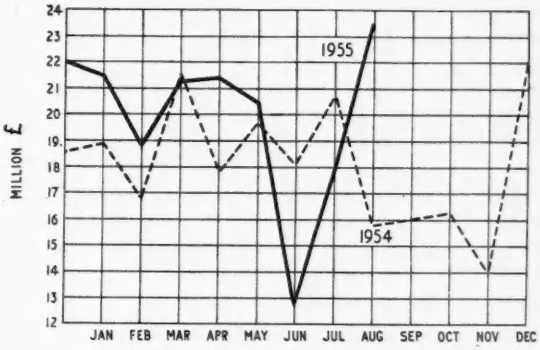



*Fig. 2.—United Kingdom monthly exports*

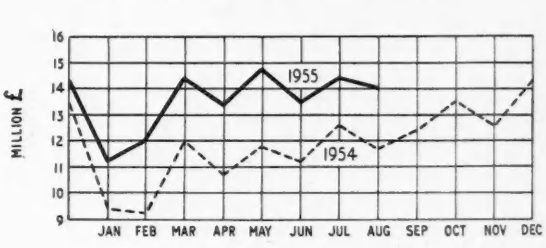



*Fig. 3.—West German monthly exports*

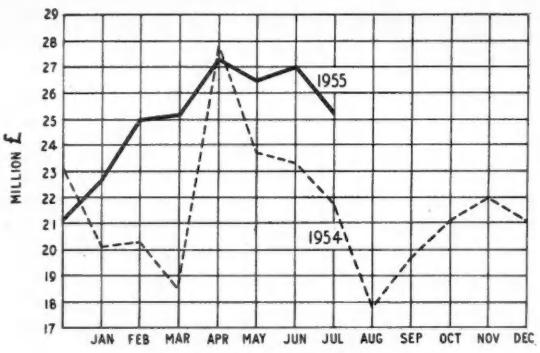



*Fig. 4.—United States monthly exports*

during 1954. The main reasons, among others, for the remarkable success in this traditional United Kingdom market are that Belgian export is considered by her industry as a self-contained entity, commercial flexibility, use of cold-rolled steel sheets for transformers, and the application of American manufacturing methods in production, apart from competitive prices, comparatively short delivery times, and extended credit terms.

AMERICAN electrical exports, after a relapse during last year, showed an increase of 14 per cent for the first seven months of 1955 (Fig. 4). The United States' main markets during 1954, in order of importance, were Canada (£70 million), Venezuela (£14·2 million), Brazil (£12·7 million), and Colombia (£10·2 million). United Kingdom electrical exports to the U.S.A. during 1954 remained nearly stationary at £2·7 million, while those of Western Germany increased by 75 per cent to £2·1 million.

After a setback in 1953 the JAPANESE electrical industry recovered last year and exported some £6·6 million worth of goods. India and Pakistan, among the United Kingdom markets, were supplied by Japan with transformers, switchgear and porcelain insulators. Japan imported some £0·9 million worth of electrical goods from the United Kingdom, about £0·4 million from Western Germany, and £2·4 million from the United States. As in former years, Japan is striving to increase her manufacturing agreements with American and Continental firms in order to modernize her production methods.

AUSTRIA'S electrical exports showed a steady increase of 16 per cent to £5·9 million during 1954. This remarkable success was achieved in spite of the fact that three of her four local electrical industries had been incorporated in the economy of the Russian controlled "U.S.I.A." concerns, thus being unable to form their own sales policy. Though her electrical industry, after the signing of the Peace Treaty, is in a stage of transition, Austria will increase her exports considerably once this period has passed. Austria's traditional markets, as in pre-war years, are the Balkan states and her western neighbours. During 1954 Jugoslavia imported Austrian equipment to the value of £0·8 million, Poland £0·6 million, Turkey £0·4 million, and Western Germany and Holland each £0·3 million. Transformer exports accounted for £140,000 to Jugoslavia, £114,000 to Turkey, £64,000 to India and £49,000 to Australia. In spite of Austria's own potential electrical industry and Western Germany's strong hold on the Austrian market, the United Kingdom share could be larger, particularly in telecommunication equipment and certain domestic appliances where the home demand outpaces productive capacity.

Within the Commonwealth CANADA is not only a potential market (total electrical imports in 1954 £83·2 million) but an exporter of electrical equipment. About 88 per cent of her electrical requirements were supplied from the United States, 9·4 per cent from the United Kingdom, 0·5 per cent from Western Germany and 0·7 per cent from Holland. Her exports valued at £13·2 million last year were mainly directed to the Latin American countries.

In order to maintain Great Britain's position as the world's second largest supplier of electrical equipment the British exporter will not only have to quote at every opportunity, large or small, but will have to make strenuous efforts to explore new markets.

# A.C. IN SHIPS

VARIOUS classes of winch and other deck machinery in vessels with an a.c. main supply were reviewed in a paper presented on 8th November by Mr. A. Sidney Brown (Clarke, Chapman) to the Institute of Marine Engineers.

A chief advantage of a.c. over d.c. was said to be the use of squirrel-cage motors for most drives, thus eliminating maintenance of commutators and brush gear. On the other hand certain drives, especially winches, needed variable speed motors for which purpose d.c. provided many of the useful characteristics of earlier steam drives.

In some of the vessels considered economy had been achieved through regarding the whole of the deck machinery as one problem, using the a.c. motor of the motor-generator for driving capstans and windlasses also, thus often reducing the amount of spare equipment.

Main features of types of winch drives described related to conversion to d.c. by motor generator; conventional Ward-Leonard control; W.L. group drive, "max-speed" cargo windlasses; Westinghouse and Reliance cargo winches; and a.c. commutator motors. All these systems included d.c. motors with their commutators and brush gear, mainly to obtain variable speed. This raised the question of whether high light-hook speeds were essential.

Several winches had been supplied with a.c. embodying either squirrel-cage motors or slip-ring motors, either single- or multi-speed. The first example was a single-speed squirrel-cage motor winch with two-speed spur gear. This had merely one step for hoisting and another for lowering and gave excellent acceleration and a satisfactory lowering of all loads. It was controlled by a d.c. disc foot brake, which, with the contactor coil, was supplied from a full wave selenium rectifier.

Other examples of a.c. drives described included a three-speed squirrel-cage motor with single-speed worm gear, as used by the Admiralty; a four-speed high-torque squirrel-cage motor; dual squirrel-cage motor; two-speed pole-changing slip-ring motor; electro-hydraulic with continuously running motor; and stores and warping winches. Alternators had been developed for feeding three-phase cargo-winch motors direct from the ship's three-phase system, which gave quick regulation of voltage without hunting.

Electrical equipment for windlasses on the larger vessels was most desirably of the Ward-Leonard type, but direct a.c. drives had proved satisfactory on a number of smaller vessels, instances of which were cited. Particulars of several schemes for cable and warping capstans as used by the Admiralty on vessels with a.c. supply were also given.

Much of the electrical equipment for deck auxiliaries already fitted to ships having a.c. supplies was more costly than series-resistance controlled d.c. motor arrangements, but Ward-Leonard variable voltage systems gave a much superior control. For ships using d.c. systems, having either the windlass, capstans or winches equipped with W.L. control, the costs were approximately the same as for ships with a.c. supplies.

# Engineering in Europe

## *EXTRACTS FROM FOREIGN TECHNICAL JOURNALS*

THE foundations of widely straddled steel masts for overhead lines nowadays frequently take the form of single columns. In this case, one of the two pairs of columns will be under tensile, the other under compression stress. The design of the foundation will therefore have to be based on the more unfavourable case of stressing. Unfortunately, the young science of soil mechanics still comprises different schools of thought on what really are its basic problems and their solution; for this reason the methods to determine the safety and, indeed, the design of such simple elements as columnar foundations vary widely between different countries.

If the author bases his consideration on more or less accepted German practice and briefly outlines and illustrates the design procedure with its convenient nomographic short-cuts and aids, he does not fail to mention deviating opinions in other countries and also to stress the necessity for deciding on one or the other design procedures only after a sufficient number of preliminary tests in every kind of soil to be found along the projected route of the line.—" Low-Cost Column-Type Foundations for Overhead Line Towers," K. Kohler, *Elektrizitätswirtschaft*, Vol. 54, No. 14, pp. 441-444, 20th July, 1955, in German.

### Machine End Connections

Two types of discharges may occur on the end connections of rotating h.v. machinery, viz., corona discharges, if the voltage between the surfaces of the insulations of different phases is high enough to ionize the air in between, and capacitive discharges along dirty winding insulation on machines of 10 kV and higher ratings. The first type of discharge is mostly harmless, whereas the second constitutes a danger to insulation, particularly on a cotton basis. It may also occur between bars of the winding and spacers, unless they are in close contact, and set fire to unimpregnated parts of the insulation, especially those of organic materials. The risk of such discharges is greatly increased by dust and dirt deposits on the windings, although capacitive discharges are not really a frequent occurrence in actual service. However, during h.v. tests on machines special attention must be paid to the end connections and wherever discharges are observed, the interstices representing the discharge gaps should be filled in with flameproof insulating material.—" Partial Discharges on End Connections of the Windings of Large Electrical Machines," B. V. Vanin and V. B. Kulakovskii, *Elektrichestvo*, No. 3, pp. 62-66, 1955, in Russian.

### Increasing Transmission Capacities

In the author's representation of the problem the main stress is laid on the power factor, since its improvement is in most cases the over-riding interest and therefore also the correct starting point for any consideration of the problems of line " reinforcement," reduction of losses and voltage stability. The approach is simple and more practical than theoretical, since the author considers from the beginning concrete examples of 22 kV lines with conductor materials and sections actually used and presents graphs of reinforcement and compensation factors achievable against p.f.

The cases considered are compensation by shunt capacitors of (*a*) a line with a load at the receiving end, (*b*) a line with several loads connected to it, (*c*) uniformly distributed load. Optimum results are achieved if the VAr are in the main compensated for at consumers' plants, and only a residual fraction is dealt with in the system; in the case of a distributed load the best place for installing a capacitor bank is in the last third of the line. The reinforcement is most effective on lines with conductors of large section and a poor p.f. Where voltage regulation is difficult, it may be advantageous to concentrate the impedance at the end of the line. The economic aspects of the problem will be dealt with in a separate paper.—" Increase of the Transmitting Capacity of H.V. Distribution Systems and Reduction of their Losses by Static Capacitors," B. Pavlovsky, *Elektrotech. Obzor*, Vol. 44, No. 7, pp. 367-374, July, 1955, in Czech.

### Transmission Efficiency

The article supplements another, more general, consideration of the efficiency of power distribution by H. Rich, in the same issue of the journal, and sets out to demonstrate that a much simpler representation than that based on the relation between losses and voltage drops may be obtained by introducing the concepts of efficiency, thus, ratio of receiving end to sending end power, supra-marginal efficiency, defined as the ratio of the corresponding power increments, and marginal efficiency, i.e. the limit of the preceding ratio for evanescent receiving-end power. It is very convenient to represent the efficiency characteristics in terms of increases of the power demand from an initial state by a curve sheet in which the curves of equal efficiency are parabolas. The great interest of this method resides in the application to a composite distribution system of radial configuration which, whilst obviously being more laborious, still enjoys the advantages demonstrated with reference to the simple case of a single line. Also, some conclusions on the relative magnitudes of efficiencies of single lines and radial systems are drawn from simple mathematical deviations. These confirm the results obtained by Rich in a much more laborious way and are a valuable aid to the system designer and economic planner.—" Comparative Investigation of the Efficiency of a Single Transmission Line and of a Radial Distribution System," P. Graff, *Bull. Soc. Franc. Elect.*, 7th Series, Vol. 5, No. 53, pp. 266-273, May, 1955, in French.

### Honnef Wind Generators

The distinctive features of the Honnef type of wind-power generators are a " double turbine " consisting of two wind wheels rotating in opposite senses and automatically controlled in accordance with the wind speed so that the torque produced has a constant value independent of the wind speed. This difficult control problem is solved by swivelling the plane of the wind wheels (having rigid, i.e., constant-pitch blades), which also enables the bearing

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

stresses to be fully compensated for by the torque of the wind force. The electric generator is of a special " ring " type and its rotor is solid with one of the wind wheels, thus eliminating transmission problems. (This applies to the type with coaxial wind wheels.)

These wind turbines, developed systematically over more than 30 years, are so far the only type designed for outputs up to several megawatts, although the war interrupted the erection of plants of this size. The inventor insists on the erection of these turbines on towers of adequate height, which not only assures that the rated output is actually achieved, but also lifts the turbine above the turbulent zone near the surface and protects it from dangerous wind gusts. Many tests on smaller units have shown that the useful range of wind speeds for this turbine, which runs up at 1 metre/sec, is from 3·5 to 20 metres/sec and the automatic output control is rapid and smooth. Parallel operation with an existing power system is therefore feasible.—" The Present State of the Art in Honnef Wind Power Plants," P. Juchem, *E.T.Z.(B)*, Vol. 7, No. 5, pp. 187-191, 21st May, 1955, in German.

## Rubber Dielectrics

The moisture-proofness and repellency of certain insulating materials, mostly belonging to the elastomers, though very important for the manufacture of moisture-resistant conductors and cables without metal sheaths, has so far received little attention from research workers who mostly concentrate on impregnated-paper insulation. A comprehensive theoretical and experimental investigation carried out in the Moscow Electrotechnical Institute on three types of commercial rubber mixtures containing 50, 80 and 100 per cent synthetic rubber, and one type containing mainly natural rubber, showed that whilst the general character of the effects on various rubber mixtures remains the same, there are great quantitative differences between the various mixtures. As would be expected, the water absorption is greatest under storage in hot water.

In all cases the dielectric loss angle increases rapidly during the first three days of storage in water or in a very moist atmosphere and then the increase is at a much reduced rate or tan $\delta$ may remain almost constant (in one case there was a slight drop). The dielectric constant of vulcanized rubber is not much affected by moisture. The breakdown strength of vulcanized rubber fell at a much slower rate than the loss angle, reaching half the initial value only after 20 days' storage in an atmosphere of 100 per cent humidity, or remaining above this value. The resistivity of the rubber products was reduced by 1-2 orders of magnitude after five/six days and then remained practically constant. Synthetic rubber is in this respect fully equivalent to natural rubber; if anything, its moisture absorption is rather lower than that of natural rubber.—" Effects of Moisture on the Dielectric Properties of Insulating Rubber," S. M. Bragin and M. M. Markosyan, *Elektrichestvo*, No. 3, pp. 54-56, 1955, in Russian.

## Capacitor Breakdowns

The surprising difference between the times taken for breakdown to occur in a capacitor tested with d.c. and with impulse voltages of the same magnitude (e.g., 10 min against 80 sec at 62 kV) indicate the different nature of the breakdown mechanisms in both cases. Investigations to clarify the processes leading to impulse-breakdown showed that the first stage consists of partial surface discharges along the edges of the capacitor sections which displace the oil from the edges and also decompose it, so that the subsequent discharges are typical gas discharges. What is more, the gaseous decomposition products of the oil form an explosive mixture, the main components of which are about 62 per cent hydrogen, 7·5 per cent oxygen and 9 per cent $CH_4$ so that at least " micro-explosions " may play a role in the destruction of the dielectric. The decomposition of the oil leads also to X-wax formation which, again, is concentrated on the edges of the sections. Subsequent discharges increase the amount of gas evolved, reduce the ionization voltage and so precipitate the destruction of the capacitor section which is partly accomplished by the carbonization of the X-wax deposits.

As a means of prolonging the useful life of the capacitors the author recommends an increase of the pressure used for compressing the capacitor sections to 20-30 kg/sq cm and periodically degassing the oil in capacitor tanks. Still higher pressures would probably damage the paper dielectric.—" The Breakdown Processes of the Dielectric of Oil-Paper Capacitors for Impulse Circuits," Yu. V. Bagalei, *Elektrichestvo*, No. 3, pp. 66-70, 1955, in Russian.

## Surge Diverters

Surge diverters have been used for twenty-five years and their development during this period has been steady so that nowadays types for every special purpose exist. In particular, cathode fall diverters have almost completely displaced expulsion-type diverters because the former are much less sensitive to atmospheric conditions and have become much cheaper, whilst the shortcomings of the latter type could not be eliminated even at a greater expense.

The remarkable fact is that the improvements were mainly obtained by using resistance elements of a slightly modified disc shape and increasing the number of partial spark gaps (though the previous series gap could be omitted), using nitrogen filling to prevent deterioration of the internal parts, and by re-designing the petticoat porcelain insulator housing the diverter proper, to increase the flashover strength. And yet, the new diverter is cheaper than the previous types. The delicate problem of correctly balancing the relative values of a.c. breakdown voltages and impulse breakdown voltages of the diverters has also been solved.—" Cathode Fall Surge Diverters for Medium-Voltage Installations," H. Bitter, *Siemens-Z.*, Vol. 29, No. 9, pp. 400-408, August, 1955, in German.

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# Computers in the Office

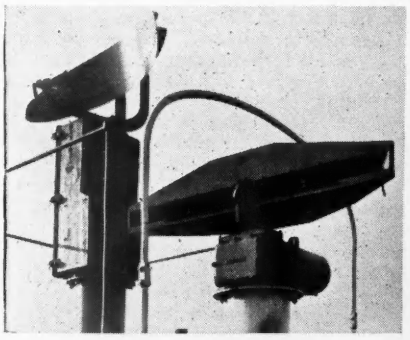
AT the British Institute of Management Conference at Harrogate Dr. B. V. Bowden, principal of the Manchester College of Technology, gave a paper on " The Electronic Processing of Data for Management." In this he reviewed some of the tasks at which computers had already proved their worth and mentioned some of those to which they would probably be applied. He referred to the fact that the U.S.A. had built over $230 million worth of computers already and had another $180 million worth on order, beside which our own production to date, worth a little more than one million pounds, was very small indeed.

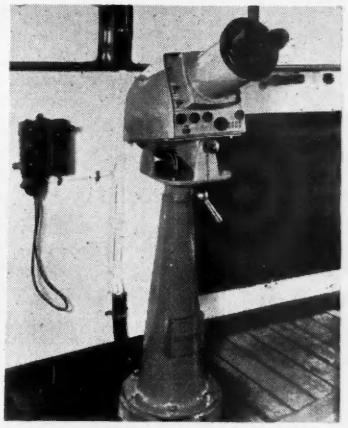
There seemed from his remarks little doubt that great savings could be made, not only in clerical man-power (and there are 2¼ million clerks in this country) but by economies as a result of speedy stock records, etc., and the analysis of alternative ways of organizing such arrangements as transport or machines for production, often virtually impossible of analysis by ordinary methods.

He stressed that it took quite a long time and a good deal of research for any firm to understand how to use a computer to its greatest advantage and how to divide the accounting procedure or whatever was involved into a simple and logical system to feed to a machine. This process could cost more than the machine itself but the savings were well worth it and more savings often resulted from the preparatory analysis of such a process, before the computers were used. Such was the value of a completely new approach to routine matters.

# Compact Marine Radar Unit

DESIGNED to meet the requirements of ships in which cost, space, and power consumption are important factors, the Marconi Marine "Quo Vadis" radar unit is by no means a "baby" radar in performance, research and the use of advanced circuit technique having shown how economies of size and weight could be achieved without impairing efficiency. It is highly flexible in so far as installation work is concerned as provision has been made for the transmitter unit to be fitted below deck with a waveguide run to the aerial scanner, or alternatively incorporated in the aerial pedestal immediately below the scanner, in which case no waveguide run is necessary.





*The "Quo Vadis" (left) and "Radiolocator IV" aerial scanners. The right-hand photograph shows the display unit of the new "Quo Vadis" equipment*

The display unit provides five viewing ranges. These cover radial distances of 0·6, 1·2, 3, 10 and 30 miles. Another model is being made available with ranges of 1, 3, 10, 20 and 40 miles.

Automatic switching of pulse lengths, first introduced in 1950 in the "Radiolocator IV," is from 0·1 microsecond on ranges of 3 miles or less, to 1·0 microsecond above 3 miles, thus ensuring sharp definition at close range and sustained hitting power at longer distances. The range in use is indicated in an illuminated panel on the front of the instrument. The display unit employs only twelve valves, including the cathode ray tube. The latter gives a 6in display, and a detachable viewing hood with built-in magnifier brings this up to an effective 9in P.P.I. The hood aperture permits simultaneous viewing by two persons without difficulty or discomfort. The weight of the display unit in its light-alloy cast case is only 33 lb, and an adjustable pedestal is available although the display can also be mounted on a chart table or desk.

A new type of offset fed parabolic aerial is used for scanning which requires no de-icing equipment. A fixed position performance monitor is fed from a small section of waveguide which rotates with the scanner at 25 r.p.m. The "Quo Vadis" is normally supplied for operation from 110 or 220 V d.c., or from 115 V 50/60 c/s a.c., but provision can be made for operation from other types of mains supply if necessary. Its peak power is 20 kW, ensuring detection of long-range targets.

Operational controls include those for adjusting tuning, gain, sea clutter, rain clutter, P.P.I. brilliance, bearing scale illumination, bearing cursor rotation, and range rings. Heading marker and performance indicator can be switched on or off as required, and an expanded centre device operates on the 0·6 and 1·2 mile ranges. The "Quo Vadis" is supplied with all necessary test equipment and a full complement of spares, and provided with comprehensive metering facilities.

# Central African Imports

THE new Federation of Northern and Southern Rhodesia and Nyasaland has published its import trade statistics in detail for 1954. Those relating to the electrical trade are given in the accompanying table. The Statistical Department states in a preliminary foreword that owing to the different classification existing previously in the countries concerned no satisfactory comparable figures with 1953 can be computed. Noteworthy points are the predominant position of the United Kingdom and the maintenance of the Union of South Africa in second place. The Netherlands and Sweden are competing in certain lines with some success. The market prospects in the new Federation were reviewed in our issue of 11th March last, page 147.

| Class of Goods | £ (000) 1954 |
|---|---|
| Batteries | 359 |
| *From U.K.* | 163 |
| ,, *South Africa* | 182 |
| Motors and parts | 315 |
| *From U.K.* | 219 |
| ,, *South Africa* | 87 |
| Transformers | 510 |
| *From U.K.* | 462 |
| ,, *South Africa* | 47 |
| Switchgear | 727 |
| *From U.K.* | 664 |
| ,, *South Africa* | 48 |
| Other electrical machinery | 1,686 |
| *From U.K.* | 1,486 |
| ,, *South Africa* | 146 |
| ,, *U.S.A.* | 35 |
| Cable and wire | 1,147 |
| *From U.K.* | 452 |
| ,, *South Africa* | 664 |
| Conduit tubing and fittings | 86 |
| *From U.K.* | 61 |
| ,, *South Africa* | 25 |
| Lamp bulbs | 125 |
| *From U.K.* | 76 |
| ,, *South Africa* | 30 |
| ,, *U.S.A.* | 16 |
| Telegraph and telephone material and apparatus | 501 |
| *From U.K.* | 473 |
| ,, *Netherlands* | 20 |
| Radios, radiograms and parts | 540 |
| *From U.K.* | 356 |
| ,, *South Africa* | 112 |
| ,, *Netherlands* | 48 |
| Refrigerators, domestic, and parts | 469 |
| *From U.K.* | 239 |
| ,, *South Africa* | 192 |
| ,, *U.S.A.* | 25 |
| Stoves, hot plates, etc. and parts | 165 |
| *From U.K.* | 54 |
| ,, *South Africa* | 107 |
| Washing machines | 94 |
| *From U.K.* | 81 |
| Other heating and cooking appliances | 179 |
| *From U.K.* | 113 |
| ,, *South Africa* | 65 |
| Other elec. goods and apparatus | 1,012 |
| *From U.K.* | 663 |
| ,, *South Africa* | 309 |
| ,, *U.S.A.* | 34 |

## DIESEL ENGINEERS

In drawing attention to its recent change of name to Diesel Engineers' and Users' Association, the former Diesel Engine Users' Association recalls that it was founded in 1913 to further the interests of users of heavy oil engines, gas engines, and (later) gas turbines, and in the intervening 40-odd years it has discharged the object by the discussion of papers dealing with every practical aspect of internal combustion engines and with every advance and development in this field.

Membership of the Association is open not only to the actual users of heavy oil engines, etc., as its former name might imply, that is, to chief engineers, managers and assistant engineers of installations and public bodies and private organizations having interests in them, but also to designers and engineers engaged in their construction. It is to make the appeal of the Association to a wider circle of engineers that the title has recently been changed.

# GENERATION AND DEVELOPMENT

### *Blyth Power Station*

Several North-East local authorities are to continue their opposition in the House of Commons against the Blyth Generating Station (Ancillary Powers) Bill which has been passed by the House of Lords. The authorities are not opposing the erection of the power station, but contend that the scheme to dispose of ash from the station by sluicing it into the sea from a pipeline at Cambois beach may be harmful to coastal amenities as the ash may be washed back on to the beaches. Opposing authorities include Northumberland County Council, Northumberland River Board, and the local councils of Tynemouth, South Shields and Sunderland.

### *High Marnham Boilers*

Some details have become available of the first three boilers to be ordered by the Central Electricity Authority for the largest station yet planned, at High Marnham in Nottinghamshire. The contract has been placed with International Combustion, Ltd., of Derby, and amounts in cost to nearly £10,000,000. The boilers, which will each be associated with one 200 MW set, will have an evaporation of 1,400,000 lb/hr. The superheater outlet pressure is 2,450 lb/sq in at 1,060 deg F. A reheat cycle is to be used, the reheater steam flow being 1,250,000 lb/hr with inlet conditions of 512 lb/sq in and 674 deg F and outlet conditions of 476 lb/sq in and 1,005 deg F.

The boilers will be of the Lopulco radiant design of the twin furnace assisted circulation type with superheater, reheater, economizers and air heaters, fired by pulverized fuel with upward gas flow in the combustion chambers of the dry ash type.

The two furnaces are similar and are connected on the steam and water side in parallel to the steam drum through the downcomers, circulating pumps and distributing drums at the bottom of the furnace. All furnace walls and the roofs are formed of close pitched small diameter tubes; there is no convection surface in the accepted sense of the word.

The furnaces are distinguished by the function of the heating surface arranged at the furnace exit, which is in the one case the secondary superheater and in the other case the reheater, the primary superheater being common to both furnaces.

The pulverizing equipment includes six Lopulco mills of a new design which has for its object the reduction of body size in relation to the output of the mill. When using the design fuel, four mills will carry the full load and for fuels lower in the scale a fifth mill can be used, leaving a spare mill for all conditions of operation.

The coal burners are of the corner mounted tilting type. There are eight burner assemblies, one in each corner of each combustion chamber with six burner nozzles in each assembly tangentially directed towards the furnace centre.

### *Power from the Tides*

Speaking at the annual dinner of the Ulster Section of the Electrical Power Engineers' Association in Belfast, Col. J. Parr-Morley, president of the Association, said that the tides cut deep into Northern Ireland and in them there was a vast source of power which could produce electricity cheaper than atomic energy. Recently he had visited a plant in France which, when completed, would produce electricity in this way.

Mr. R. P. Watson, city electrical engineer of Belfast, spoke of the expansion of electricity supply in Ulster and Mr. H. Norton, general secretary of the Association, said that the way in which Northern Ireland had claimed its share of Britain's atomic power programme showed that the electricity industry was not content just to be prosperous now, but was determined to be prosperous in the future also.

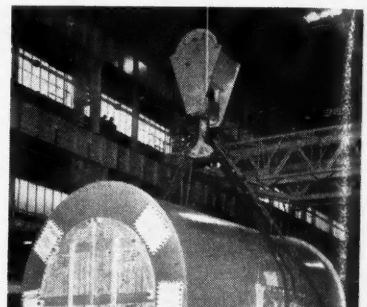
### *Distribution Reinforcement*

The South of Scotland Electricity Board has approved the provision of two new 1,000 kVA substations at Polwarth Grove and Mardale Crescent, Edinburgh, to reinforce the supply to the surrounding area. The scheme, which will cost approximately £18,000, will reduce the load on Bruntsfield and Merchiston Mews substations and improve the voltage regulation of the area.

To reinforce the supply to Annan two 5,000 kVA 33/11 kV transformers at Annan substation are to be replaced by two 10,000 kVA units at an estimated cost of £37,400.

### *Plant for Castle Donington*

The Metropolitan-Vickers Electrical Co., Ltd., has in hand the manufacture of six 100 MW turbo-generators for Castle Donington power station (C.E.A. East Midlands Division). When completed this power station will be the largest in Europe. The generators will be hydrogen cooled and will be the largest of this type so far built in this country. The stator of the first generator is being delivered by road transport and left the works on 5th November; the journey was expected to take about five days. Stripped of all removable items, such as the hydrogen coolers, the stator



*Stator of 100 MW turbo-alternator being loaded for transport to Castle Donington*

weighed approximately 140 tons and on account of its size a special route was planned in collaboration with the Ministry of Transport and local authorities, police escort being provided by the various counties through which the equipment passed.

When erected on site the turbo-generators will be 80ft in length, each set weighing over 400 tons. The turbines will be direct-coupled to the generators, running at 3,000 r.p.m. with initial steam conditions of 1,500 lb/sq in and 1,050 deg F.

An important feature of design is the close coupling of the high-pressure and low-pressure turbine rotors by means of a solid coupling. Thus, with only one central bearing and a single thrust block to locate the combined rotor, a considerable saving in length is achieved.

### *Melting out an Old Cable*

Many services, including two h.v. cables, pass over the narrow Galton Bridge which, built in the early part of the 19th century by Thomas Telford, carries heavy traffic over a canal at Smethwick. In the course of a reinforcement scheme to meet the growing industrial demand for power, engineers of the Smethwick and Oldbury District of the Midlands Electricity Board found it necessary to take another 11 kV cable across the bridge and because of the possibility of damage to the structure and to avoid disruption of traffic it was decided to withdraw an obsolete cable from its steel conduit and replace it with a new cable.

Examination revealed that the old cable, laid just over 40 years ago by the Shropshire, Worcestershire & Staffordshire Power Co., had become firmly welded into the steel conduit. The steel pipe was 3½in in diameter and the old cable passing through it was 2⅞in in diameter, with double steel tape armour, plus a jute covering,

heavily compounded with bitumen. After unsuccessful efforts to withdraw the cable by hauling with a winch on the core, Mr. A. E. Price, engineer of the South Staffs and North Worcs Sub-Area of the M.E.B., suggested that the cable might be withdrawn by melting the surrounding bitumen compound by passing current through the old cable. Following successful experiments with a 20 yd length of the old cable, this method was adopted by the district engineer, Mr. H. Hawkins.

About 240 yd of the old cable had to be removed. This was divided into two 120 yd lengths at a central inspection chamber. Current taken from a 500 kVA transformer at a nearby substation was passed at 230 A through the core of the cable and returned through the armour plating, and the cable was warmed up in this way for two to three hours. At the inspection chamber all cores of the cable were bonded together to form an " American eye " and by this means the cable was attached to a chain, which was hauled by a 10-ton, 120 h.p. mobile crane vehicle hired from a local steelworks.

The first 120 yd length, which lay straight in the steel pipe, was withdrawn without difficulty after preliminary heating, but the second length, which curved, had to be broken at an intermediate point and was then successfully withdrawn in two lengths of 80 and 40 yd.

### *European Power Needs*

The Commission of Energy set up by the Organization for European Economic Co-operation, of which Sir Harold Hartley is chairman, recently held its first meetings in Paris. Among the subjects discussed was the need to obtain sufficient information from Governments of member countries to enable estimates to be formed of the power needs and output in 1960 and 1975. The questions it was decided to put concerned prices, investment, man-power and the international exchange of energy as well as production, transmission and utilization technical problems.

### *Re-introduction of Assisted Wiring Schemes Sought*

Having discussed the problem of faulty wiring in houses, Hackney Borough Council made representations to the Central Electricity Authority urging that assisted wiring schemes should be introduced. At a recent meeting of the Housing Committee it was reported that a reply had been received from the deputy secretary of the C.E.A. in which he said that the possibility of reintroducing assisted or extended-payment wiring schemes had always been kept in mind by the Authority. The chairmen of the Area Boards, who were primarily concerned, had considered the matter in conference on more than one occasion and had reached the conclusion that it would be impracticable to revert to the pre-war practice. In February this year the London Electricity Board had indicated the difficulties common to all Boards which led to this decision. The purpose of the pre-war assisted wiring schemes operated by some of the electricity undertakings was to secure a more rapid adoption of electricity supply than would otherwise have been possible, not to relieve the owners of property of the normal responsibility for maintaining the wiring installation in a satisfactory condition.

The Hackney Housing Committee says it now understands that the Minister of Fuel and Power takes the view that the question of assisted wiring is one for the London Electricity Board to consider on its merits. There should be no question of the Government seeking by legislation to compel Boards to undertake such schemes nor to subsidize them if the Boards themselves find that the schemes are financially unattractive. Accordingly the Metropolitan Boroughs Standing Joint Committee has drawn the attention of the London Electricity Consultative Committee to the problem with the request that it should urge the Board to introduce assisted wiring schemes.

### *Plant for Canada*

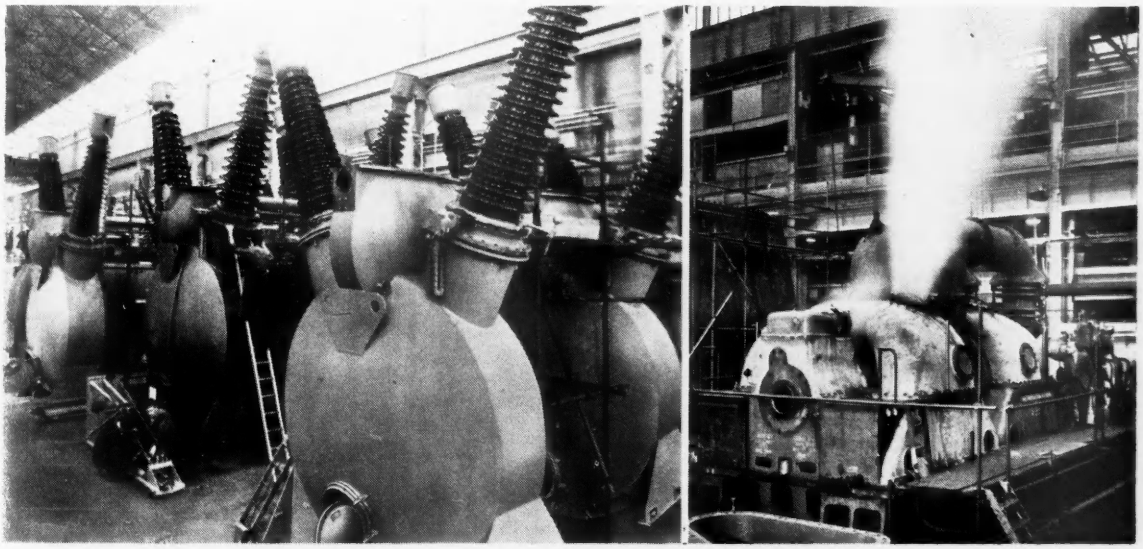
Early this year the British Thomson-Houston Co., Ltd., reported having received an order from the British Columbia Electric Co., Ltd., for six 230 kV, 7,500 MVA oil circuit-breakers; subsequently a seventh breaker was ordered. These equipments are now in course of manufacture at the B.T.H. Willesden works and two of them are shown in the left-hand photograph. Also seen in the picture is a 275 kV breaker for the C.E.A. supergrid.

Undergoing tests at the Metropolitan-Vickers Trafford Park factory is a 66,000 kW turbo-generator for the Wabamun power station, Calgary, Alberta. The test illustrated in the accompanying photograph involved the deliberate fracture of one of the rupturing diaphragms fitted in the turbine casing. In service, the rupturing diaphragm would function only in the event of an excess of pressure in the turbine exhaust, such as might arise from an interruption of the cooling water supply, and the consequent loss of vacuum.

### *Trolley-bus Overhead Equipment*

Belfast City Council proposes to seek sanction to borrow £28,500 for the construction of new trolley-bus overhead equipment.

*Left : B.T.H. 230 kV, 7,500 MVA oil circuit-breakers ordered by the British Columbia Electric Co. Right : A 66,000 kW Metropolitan-Vickers turbo-generator for Wabamun power station, Calgary, undergoing tests at Trafford Park*



## *Financial Section*

# STOCKS and SHARES

STOCK EXCHANGE markets have been unable to make headway against uncertainties created by political developments abroad, by the wage claims expected to take shape at home in the near future, and by signs of a further tightening of the credit squeeze. Gilt-edged stocks were helped by the latest report on the gold and dollar reserves, and by the beneficial effect which this had upon the sterling exchange rates, but lost ground on balance. In the industrial market, the comparatively good yields shown by many first rate ordinary shares attracted some investment support, and activity developed around several important new issues. Generally speaking, however, markets have an air of waiting somewhat uneasily upon events.

### B.I.C.C. New Shares

A prospective yield of over 5¼ per cent drew investment interest to the new British Insulated Callender's Cables £1 shares, of which 2,650,000 are offered to existing holders at 38s. The premium advanced to 8s 6d, making the all-in price 46s 6d. Acceptances had to be notified by to-day (Friday) when the first payment of 20s per share becomes due; the balance of 18s must be paid by 9th December. Until then the shares will be transferable free of the 2 per cent stamp duty. It will be recalled that in announcing the issue, which will raise some £5 million for development purposes and working capital, the directors advised stockholders of a marked improvement in the current year's earnings, and indicated a total dividend of 12½ per cent (the new shares not participating in the 4 per cent interim expected next month).

### T.I. Issue

Another big capital operation reached the market last week with the beginning of dealings in 7,247,000 new Tube Investments £1 ordinary shares, offered to shareholders on a share-for-share basis at a price of 22s 6d. The form of the offer is unusual in that the price is less than a quarter of the previous quotation for the old shares, and that the present rate of dividend is to be reduced as a result of the doubling of the capital. Consequently, as the chairman points out, stockholders cannot preserve their stake in the company without taking up an appropriate proportion of the new shares. Early dealings in the latter took place at a premium of about 33s 9d. They offer a future yield of just under 5 per cent on the dividend at the rate of 14 per cent per annum indicated by the chairman.

### "Excess" Shares

Another uncommon point about the Tube Investments issue is the arrangement made by the company as a result of which any shares not taken up are to be subscribed and sold, and the proceeds distributed for the benefit of stockholders who failed to exercise their rights. British Insulated Callender's Cables followed the more usual

## *The Week's Price Changes*

| Company or Board | Nom. Value | Middle price 7th Nov. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % | 1955 Highest | 1955 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Gilt-edged Stocks* | | | | | | £ s d | | |
| Brit. Elec. 1968/73 | 100 | 81½ | | 3 | 3 | 3 13 10 | 94⅜ | 76⅛ |
| Brit. Elec. 1974/77 | 100 | 79½ | −1 | 3 | 3 | 3 15 6 | 93⅛ | 75⅛ |
| Brit. Elec. 1976/79 | 100 | 84⅛ | | 3½ | 3½ | 4 2 10 | 98⅜ | 80½ |
| Brit. Elec. 1974/79 | 100 | 94½ | | 4¼ | 4¼ | 4 16 0 | 109 | 90½ |
| *Overseas Electric Supply* | | | | | | | | |
| Calcutta Elec. | £1 | 21/6 | | 6† | 6† | 5 11 6 | 22/6 | 20/9 |
| East African Power | £1 | 21/9 | | 7 | 7 | 6 8 9 | 24/6 | 19/9 |
| Nigerian Elec. | £1 | 21/- | | 10 | 10 | 9 10 6 | 27/- | 21/- |
| Palestine Elec. "A" | £1 | 21/- | | Nil | Ni | Nil | 22/9 | 21/- |
| Perak Hydro-Elec. | £1 | 22/- | +6d | 10 | 10 | 9 1 9 | 22/3 | 17/9 |
| *Equipment and Manufacturing* | | | | | | | | |
| Aberdare Cables | 5/- | 12/6 | | 12½ | 17½ | — | 14/6 | 11/- |
| Aerialite | 1/- | 6/3x.d. | | 88⅓ | 45* | 7 4 0 | 6/7 | 5/3 |
| Allen, W. H. | £1 | 73/9 | | 20 | 20 | 5 8 6 | 83/9 | 75/- |
| Aron Elec. Ord. | £1 | 55/6 | | 15 | 15 | 5 8 0 | 63/9 | 55/6 |
| Assoc. Elec. Ord. | £1 | 76/6 | −2/- | 11⅛ | 14 | 3 13 3 | 96/- | 62/6 |
| Automatic Tel. & El. | £1 | 61/3 | | 15 | 15* | 4 18 0 | 79/6 | 60/- |
| Babcock & Wilcox | £1 | 78/9 | +1/3 | 12* | 15 | 3 16 3 | 98/- | 68/6 |
| Baldwin, H. | 2/- | 5/- | | 20 | 20 | 8 0 0 | 5/6 | 4/4 |
| Bakelite | 10/- | 33/-x.d. | +1/6 | 12½ | 16 | 4 17 0 | 34/6 | 27/- |
| British Aluminium | £1 | 48/3 | −6d | 10 | 12 | 4 19 6 | 58/- | 35/3 |
| B.I. Callender's | £1 | 46/6 | +1/- | 10 | 12½‡ | 5 7 6 | 55/3 | 44/9 |
| B.I. Callender's 6% Pref. | £1 | 23/6 | | 6 | 6 | 5 2 2 | 26/6 | 21/9 |
| British Thermostat | 5/- | 30/- | | 27½ | 27½ | 4 11 9 | 35/- | 22/6 |
| British Vac. Cleaner | 5/- | 6/6 | | 25 | 30 | — | 10/- | 6/6 |
| Brook Motors | 10/- | 43/9 | −9d | 20 | 20* | 4 11 6 | 46/3 | 39/9 |
| Brush Ord. | 5/- | 7/6 | | 6 | 10 | 6 13 3 | 9/6 | 7/6 |
| Bulgin, A. F. | 1/- | 7/- | | 30 | 45 | 6 8 6 | 8/- | 4/- |
| Burco Dean | 5/- | 12/3 | | — | — | — | 17/3 | 12/6 |
| Chloride El. Storage | £1 | 66/3 | +1/3 | 12½ | 17½ | 5 5 9 | 77/6 | 58/6 |
| Clarke Chapman | £1 | 92/6 | | 20 | 20* | 4 6 6 | 102/6 | 68/9 |
| Cole, E. K. | 5/- | 20/6 | | 27½ | 17½* | 4 5 3 | 25/6 | 18/3 |
| Cossor, A. C. | 5/- | 9/6 | | 10 | 15 | 7 18 0 | 14/- | 8/9 |
| Crabtree | 10/- | 29/- | | 20 | 20 | 6 18 0 | 34/6 | 27/6 |
| Crompton Parkinson Ord. | 5/- | 16/- | | 20 | 16* | 5 0 0 | 19/9 | 15/- |
| De La Rue | 5/- | 20/9 | +9d | 20 | 30 | 7 4 6 | 26/- | 17/- |
| Decca | 4/- | 38/9 | +1/3 | 35 | 56¼* | — | 48/9 | 31/- |
| Desoutter | 5/- | 31/3 | | 20 | 25 | 4 0 0 | 35/- | 25/6 |
| Dewhurst | 2/- | 11/- | +1/- | 19 | 24 | 4 7 3 | 11/- | 7/3 |
| Dictograph Tel. | 2/- | 7/6 | | 20 | 20 | 5 6 9 | 9/3 | 6/6 |
| Dubilier Condenser | 1/- | 4/6 | | 25 | 25* | 5 11 0 | 5/7 | 3/1 |
| E.M.I. | 10/- | 26/3x.d. | | 10 | 15 | 5 14 3 | 37/- | 25/3 |
| Electrical Components | 5/- | 13/9 | | 20 | 25 | 9 1 9 | 21/3 | 13/9 |
| Elec. Construction | £1 | 30/- | | 15 | 8½* | 5 13 3 | 41/3 | 30/- |
| Enfield Cable Ord. | £1 | 20/- | | Nil | Nil | Nil | 25/3 | 20/- |
| English Electric | £1 | 61/6 | | 10 | 12½ | 4 1 3 | 86/9 | 54/3 |
| English Electric 3¾% Pref. | £1 | 14/6 | | 3¾ | 3¾ | 5 3 6 | 16/9 | 14/- |
| Ericsson Tel. | 5/- | 40/9 | +9d | 25† | 25*† | 3 1 3† | 46/6 | 29/- |
| Ever Ready | 5/- | 33/- | +6d | 40 | 35* | 5 6 0 | 38/- | 22/3 |
| Falk Stadelmann | £1 | 47/6 | +1/- | 15 | 17½ | 7 7 3 | 52/6 | 42/- |
| G.E.C. Ord. | £1 | 61/6 | | 12½ | 14 | 4 11 0 | 80/3 | 51/3 |
| G.E.C. 6½% Pref. | £1 | 25/3 | | 6½ | 6½ | 5 3 0 | 28/4 | 23/6 |
| General Cables | 5/- | 15/9 | | 30 | 30 | 9 10 6 | 17/- | 15/- |
| Greenwood & Batley | £1 | 50/- | | 17½ | 17½ | 7 0 0 | 57/6 | 50/- |
| Hackbridge Cable | 5/- | 22/3 | +1/6 | 20 | 25 | 12 3 | 22/9 | 14/- |
| Hackbridge & Hewittic | 5/- | 20/9 | | 25 | 30 | — | 24/9 | 17/- |
| Hall Tel. Acc. | 10/- | 31/- | +3/- | 10 | 10 | 3 4 6 | 31/- | 11/- |
| Heatrae | 2/- | 5/- | | 12½ | 15 | 6 0 0 | 5/9 | 4/3 |
| Henley's | 10/- | 16/9 | | 10½ | 10½ | 6 5 6 | 21/3 | 15/9 |
| Holophane | 5/- | 18/9x.d. | +6d | 25 | 30 | 8 0 0 | 19/9 | 16/- |

* After scrip issue. † Free of income tax. ‡ Dividend forecast.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List

procedure of inviting stockholders to apply for "excess" shares (those not taken up by way of rights), and also for an additional 180,000 shares. The persistent flow of "rights" issues is a reason for calling attention again to the advantage which can often be secured by an application for excess shares where a sizeable premium has developed on the new shares.

## Top Prices

Few of this week's changes in the accompanying price lists are of any particular consequence, but it is worthy of note that circumstances did not prevent three or four shares from notching their best prices of the year. Among them were Dewhurst & Partner 2s ordinary, which rose to 11s in advance of the final dividend declaration. Hackbridge Cable at 22s 9d (reverting later to 22s 3d) and Wolf Electric at 22s shared the same distinction, and the rise in Hall Telephones continued to 31s. Sun Electrical were nominally called 40s in the market after news of the increase in the dividend from 15 to 20 per cent. A. H. Hunt (Capacitors) were marked 19s 3d ex-rights to the new shares.

# *in Electrical Investments*

| Company or Board | Nom. Value | Middle price 7th Nov. | Week's Rise or Fall | Dividend Previous | Dividend Last | Yield % | 1955 Highest | 1955 Lowest |
|---|---|---|---|---|---|---|---|---|
| *Equipment and Manufacturing—continued.* | | | | | | £ s d | | |
| Hoover | 5/- | 38/- | +6d | 45 | 70 | 9 4 3 | 52/6 | 35/6 |
| I.C.I. | £1 | 48/9 | | 15 | 10* | 4 2 0 | 61/9 | 38/3 |
| Intl. Combustion | 5/- | 18/- | +1/- | 20 | 25 | — | 24/6 | 16/- |
| Johnson & Phillips | £1 | 39/6 | −6d | 15 | 15 | 7 12 0 | 52/6 | 39/6 |
| Lancashire Dynamo | £1 | 45/6 | | 14 | 15 | — | 56/6 | 37/3 |
| Laurence, Scott | 5/- | 16/- | | 20 | 12½* | 3 18 3 | 19/6 | 14/6 |
| Lister, R. A. | £1 | 28/9 | | 12 | 9·3* | 6 9 0 | 40/- | 28/9 |
| London Elec. Wire | £1 | 51/9x.d. | | 10 | 12½ | 4 16 6 | 61/3 | 50/6 |
| Lucas, J. | £1 | 42/6 | | 10·8 | 7½* | 3 10 6 | 56/6 | 40/- |
| Marryat & Scott | 2/- | 10/3 | | 25 | 30 | 5 17 0 | 13/- | 9/6 |
| Mather & Platt | £1 | 60/9 | | 15 | 13·4* | — | 75/- | 48/- |
| Metal Industries | £1 | 25/9 | −6d | 9 | 9 | 6 19 9 | 38/- | 25/9 |
| Midland Elec. Mfg. | £1 | 50/- | | 15 | 10* | 4 0 0 | 55/- | 44/- |
| Morphy-Richards | 4/- | 28/3x.d. | | 35 | 50 | 7 1 6 | 35/- | 27/- |
| Murex | £1 | 62/- | +1/3 | 15 | 20 | 6 9 0 | 66/- | 49/3 |
| Newman Ind. | 2/- | 2/9 | | 10 | 10 | 7 5 6 | 3/6 | 2/4 |
| Oldham & Son | 1/- | 3/- | +3d | 17½ | 20 | — | 3/6 | 2/1 |
| Parnall (Yate) | 5/- | 8/6 | +3d | 8 | 14 | 8 4 9 | 13/2 | 7/3 |
| Parsons, C. A. | £1 | 76/3 | | 7½ | 10 | 2 12 6 | 100/- | 56/- |
| Plessey | 10/- | 72/6 | +2/6 | 30 | 20* | 2 15 3 | 89/- | 57/6 |
| Pye Deferred | 5/- | 22/- | −6d | 20 | 12½* | 2 16 9 | 23/9 | 14/3 |
| Revo | 10/- | 13/- | | 9 | 9 | 6 18 6 | 15/6 | 12/6 |
| Reyrolle | £1 | 95/- | +1/3 | 13⅓ | 15 | 3 3 3 | 127/6 | 89/- |
| Rheostatic | 4/- | 12/3 | | 20 | 22½ | — | 14/3 | 9/3 |
| Richardsons Westgarth | 5/- | 15/- | | 15 | 16⅔ | 5 11 3 | 19/- | 11/- |
| Scottish Cables | 4/- | 16/3 | −1/- | 27½ | 27½ | 6 15 3 | 22/6 | 16/3 |
| Smith (England), S. | 4/- | 16/6 | +6d | 15 | 17½ | 4 4 9 | 20/- | 15/- |
| Southern Areas | £1 | 30/6 | | 7½ | 10 | 6 11 3 | 38/- | 27/6 |
| Strand Elec. | 5/- | 7/9 | −3d | 17½ | 15* | 9 13 6 | 13/3 | 7/6 |
| Sturtevant | 5/- | 30/- | | 18·9 | 14·4†* | 2 8 0† | 35/9 | 21/- |
| Sun Elec. | £1 | 35/- | | 15 | 20 | — | 35/- | 33/9 |
| Switchgear & Cowans | 5/- | 15/- | | 10 | 20 | 6 13 3 | 17/- | 11/- |
| Taylor Tunnicliff | 5/- | 13/9 | +3d | 12½ | 15 | 5 9 0 | 16/3 | 11/3 |
| T.C.C. | 10/- | 45/6 | | 30 | 25* | 5 10 0 | 53/9 | 41/- |
| T.C. & M. | £1 | 30/- | | 8½ | 8½ | 5 13 4 | 40/9 | 29/3 |
| Telephone Mfg. | 5/- | 8/3 | −3d | 10 | 10 | 6 1 3 | 11/6 | 7/9 |
| Thorn Elec. | 5/- | 22/- | +9d | 20 | 15* | 3 8 3 | 33/- | 13/9 |
| Thornycroft | £1 | 45/-x.d. | +3/6 | 15 | 15* | 6 13 3 | 47/6 | 34/6 |
| Tube Investments | £1 | 57/6x.r. | | 22½ | 14*† | 4 17 3 | 60/- | 56/6 |
| Vactric | 5/- | 16/3 | | 10 | 15* | 4 12 3 | 22/- | 12/- |
| Veritys | 5/- | 10/6 | | 12½ | 12½ | 5 19 0 | 12/2 | 7/- |
| Walsall Conduits | 4/- | 14/- | | 70 | 70 | — | 17/3 | 12/- |
| Ward & Goldstone | 5/- | 35/- | | 50 | 30* | 4 5 9 | 45/- | 32/6 |
| Watford | 2/- | 7/- | | 22½ | 25 | — | 8/9 | 6/3 |
| Westinghouse Brake | £1 | 86/3 | | 16 | 18 | 4 3 6 | 110/- | 82/- |
| West, Allen | 5/- | 13/- | +3d | 17½ | 15* | 5 15 6 | 16/6 | 8/- |
| Wolf Electric | 5/- | 22/- | +6d | 17½ | 20 | 4 11 0 | 22/- | 16/1 |
| *Trusts, Transport and Communications* | | | | | | | | |
| Anglo-Am. Tel.: | | | | | | | | |
| A. Ord. | 100 | 74½ | | 6 | 6 | 8 1 10 | 88 | 67½ |
| Ord. | 100 | 45 | | 3¾ | 3¾ | 8 6 8 | 54½ | 45 |
| Anglo-Portuguese | £1 | 24/-x.d. | | 8 | 8 | 6 13 3 | 27/- | 21/- |
| Brit. Elec. Traction: | | | | | | | | |
| Def. Ord. | 5/- | 20/-x.d. | | 50 | 22½* | 5 12 6 | 24/3 | 19/6 |
| Cable & Wireless: | | | | | | | | |
| Ord. | £1 | 41/6 | | 9 | 10 | 4 16 6 | 54/- | 39/6 |
| 4% Loan | 100 | 92½ | | 4 | 4 | 4 6 6 | 100 | 92 |
| Calcutta Trams | £1 | 25/9 | | 6† | 7½† | 5 16 6† | 26/3 | 20/- |
| Cape Elec. Trams | £1 | 18/9 | | 5½ | 7½ | 8 0 0 | 19/6 | 16/6 |
| Marconi Marine | £1 | 31/3x.d. | | 10 | 10 | 6 8 0 | 41/3 | 31/3 |
| Oriental Tel. Ord. | 1/- | 82/6 | | 16 | — | — | 102/6 | 72/6 |
| Telephone Rentals | 5/- | 11/3 | | 10 | 12½ | 5 11 0 | 13/6 | 9/6 |

## Falk Stadelmann

An improvement by just about one-third in Falk Stadelmann's group profits for the year ended last March is ascribed to a considerable increase in turnover, and was achieved despite lower profit margins and severe competition. With a net profit, after tax and other charges, of £209,000, the ordinary dividend is being raised from 15 to a well-covered 17½ per cent. The £1 shares were marked up to 47s 6d, at which level the yield becomes close on 7½ per cent. With more than half the current year completed, the company's statement says that sales throughout the group have been maintained at home and overseas.

## J. & F. Stone

A yield not much short of 9 per cent is shown by the 5s ordinary shares of J. & F. Stone Lighting & Radio, owners of the long chain of electrical equipment shops, at a price of about 28s. The record of the business is one of consistently successful expansion, and a yield of this order on the 50 per cent dividend is evidently associated with questions as to how it is likely to be affected in future by the latest hire-purchase regulations and purchase-tax rates. In the face of these, the chairman makes a confident appreciation of prospects in the recently issued annual report. He mentions in particular the benefits which have yet to materialize from the past year's growth in the amounts receivable under hire-purchase agreements from £308,000 to £1,404,000.

## Preference Shares

New 6½ per cent redeemable £1 preference shares issued by British Relay Wireless and Television are being dealt in at about 9d over par. They are 5s paid, with another 5s due on 10th January and the remaining 10s in April; until then transfers will be free of stamp duty. This issue of 500,000 shares follows the "rights" issue of 800,000 "A" ordinary shares, and is part of the operation to finance the continuance of the company's expansion programme. Particulars of the preference issue included information showing the amount of the annual preference dividend to be covered more than four times by the latest earnings.

# REPORTS and DIVIDENDS

**Tube Investments, Ltd.** — The preliminary statement for the year ended 31st July last shows trading profits of the subsidiary companies of £10,800,864, as compared with £7,685,666 for the preceding year. After deducting £2,274,287, depreciation of fixed assets, adding other income of £309,554, providing £4,393,401 for taxation, and allowing £14,207 for outside interests, the group net profit is £4,428,523 (against £2,687,484). To this is added taxation adjustments of £335,701, making £4,764,224 available. A sum of £549,220 is retained by subsidiaries and £2,750,000 is transferred to general reserve. It is proposed to pay a final ordinary dividend of 12½ per cent, making 22½ per cent for the year. This dividend is not payable on the new ordinary shares provisionally allotted to stockholders on 31st October last. The distribution for the previous year was 17½ per cent. The increase in carry-forward is £367,005.

**A. H. Hunt (Capacitors), Ltd.**—At an extraordinary meeting held on 28th October resolutions were passed increasing the authorized capital and altering the Articles of Association to permit the capitalization of the share premium account. The directors have decided to issue 247,500 new ordinary shares of 4s each for cash. These have been provisionally allotted to the existing ordinary shareholders for subscription at 16s 6d per share in the proportion of three new shares for every ten held. It is proposed, as soon as this issue has been completed, to double the then issued share capital by capitalizing £214,500 of reserves and issuing 1,072,500 new ordinary shares of 4s each credited as fully paid up in the proportion of one share for every share held. The proposed capitalization of reserves and the one-for-one issue will be submitted to an extraordinary meeting to be held on 18th November.

The proceeds of the cash issue will be used to finance the bulk of the company's programme of expansion and modernization, of which the principal elements are the erection and equipment of the factory at New Addington, Croydon, and the installation of new machinery in the factories at Wandsworth and Wrexham. Further working capital will be required to finance the increased turnover expected from these developments and this will be provided from the company's resources, including retained profits. The circular to shareholders states that sales for the current year to date show an advance on those for the corresponding period of the previous year. The directors are confident that the profits for the current year should justify the maintenance of the same final dividend as last year on the capital as increased by the cash issue, but with the capitalization of reserves the final dividend would be at the proportionate rate of 10 per cent on the total issued capital of £429,000.

**Falk, Stadelmann & Co., Ltd.**—The accounts for the year ended 31st March last show a consolidated trading profit of £629,077, as compared with £493,224 for 1953-54. After meeting all charges, including £243,448 for taxation, the group net profit is £209,012 (against £142,456), of which £85,443 is retained in the accounts of the subsidiary companies, leaving £123,569 to be dealt with in the parent company's accounts. Contingencies reserve receives £20,000 and staff benevolent fund £10,000. It is proposed to pay a final ordinary dividend of 10 per cent, making 17½ per cent for the year (against 15 per cent). The balance carried forward is £95,766 (against £89,245 brought in).

In his statement which accompanies the report and accounts, Mr. H. Falk (chairman and managing director) says that the improved results have been achieved by a considerable increase in turnover, despite lower margins of profit, in face of severe competition. Export activities have been widely extended. In the current year sales throughout the group are being maintained both at home and abroad and the export section of the parent company for the first six months shows an increase of 25 per cent. The cable works again show a record production and have increased sales. Reorganization of the Domestic Appliances Department is making headway and the new types of appliances introduced this season and others still in the development stage will increase this department's contribution to the financial results. There has been further development of the electric lighting fittings section which has carried out many noteworthy industrial and commercial installations. The overseas companies have forged ahead and this progress is being maintained during the current year.

**The Sun Electrical Co., Ltd.,** reports that after providing £48,270 for taxation, the profit for the year to 30th April last is £43,616, as compared with £24,392 for the preceding year. General reserve receives £15,000 and it is proposed to pay a final dividend of 15 per cent, making 20 per cent for the year. This compares with a single payment of 15 per cent for the previous year. The balance carried forward is £88,527 (against £75,915 brought in).

**The Strand Electric Holdings, Ltd.** —The annual meeting will be held on 14th November. In his circulated statement, Mr. J. D. H. Sheridan (chairman and joint managing director) says that during the year under review approximately 40 per cent of their production was for direct export to some seventy overseas territories. Their major problem at the moment is to cope with the volume or orders but steps are in hand to improve the productive capacity. With regard to television, substantial orders have already been executed and others are in hand for the B.B.C. and the commercial companies. In addition, there is every reason to anticipate that they will be able to obtain export orders for television equipment.

**The Perak River Hydro-Electric Power Co., Ltd.**—The annual meeting was held on 4th November, Mr. H. G. Balfour (chairman) presiding. In his circulated statement, the chairman said that the hydro-electric station at Chenderdh, owing to a lower average effective river flow, generated only 184·5 million kWh during the year under review, as compared with 204·4 million kWh in the previous year. The steam stations generated 247·5 million kWh (against 185·3 million kWh). The thermal efficiency increased from 18 per cent to 18·1 per cent at the Malim Nawar station, and from 18·4 to 18·7 per cent at the Batu Gajah station. To meet the increasing load on their system an order was placed during the year for a new 12 MW turbo-alternator and also a 140,000 lb/hr boiler which were scheduled to go into operation at Malim Nawar during 1958.

**The Atlas Electric & General Trust, Ltd.,** has declared an interim dividend of 3 per cent. No interim dividend was paid in the previous year, but the final distribution was 6½ per cent.

**The Brush Group, Ltd.,** is paying an interim dividend of 3 per cent (unchanged) on increased capital.

**Broadcast Relay Service, Ltd.,** has declared an interim dividend of 5 per cent free of tax on the ordinary stock as increased by the recent capitalization issue. The interim dividend for the previous year on smaller capital was 10 per cent.

**W. & T. Avery, Ltd.,** are paying an interim dividend of 5 per cent (unchanged).

**G. & J. Weir, Ltd.,** have declared an interim dividend of 7½ per cent (unchanged).

## New Companies

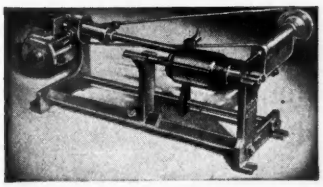
**Union Cable Co., Ltd.**—Registered 22nd October. Capital £2 in £1 shares. Manufacturers of and dealers in all kinds of insulated cables and wires for the transmission of electrical energy, etc. Directors: J. P. Hourston (director of Electric Power & Communications Trust, Ltd., etc.) and W. H. Wells. Regd. office: Norfolk House, Norfolk Street, W.C.2.

**Alston Capacitors, Ltd.**—Registered 22nd October. Capital £100. Manufacturers of and dealers in capacitors.

(*Continued on page 961*)

# MARTINDALE
# MICA UNDERCUTTERS

## AERO-AUTO



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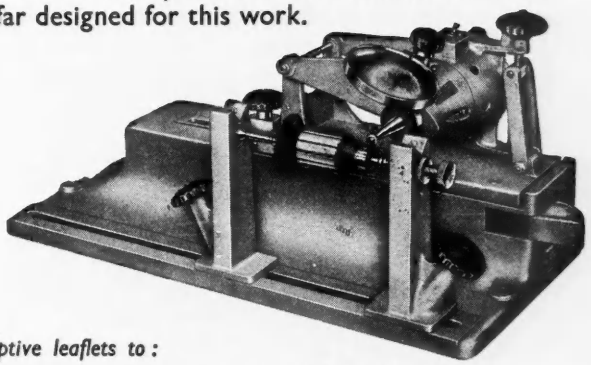

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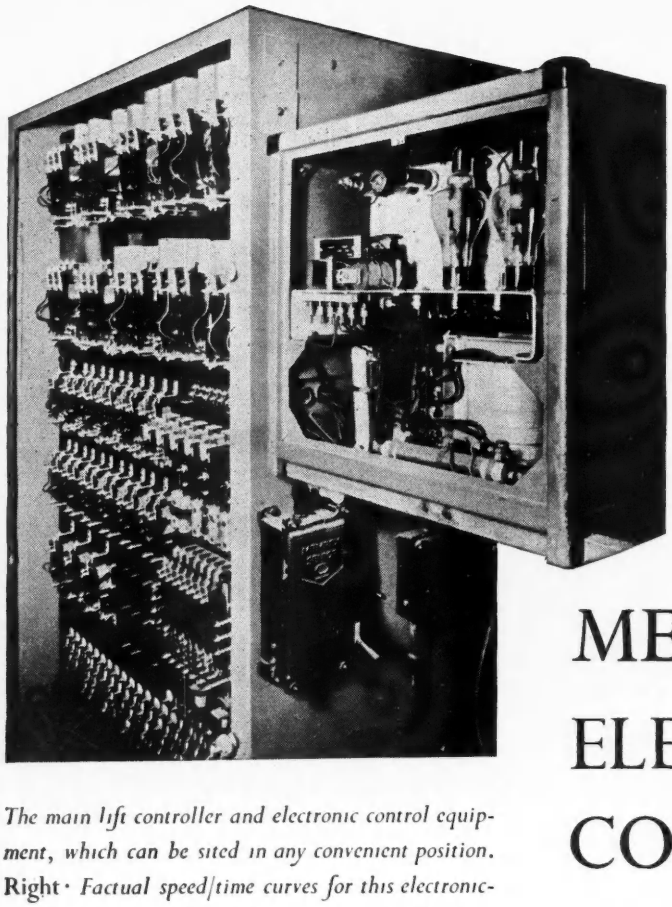
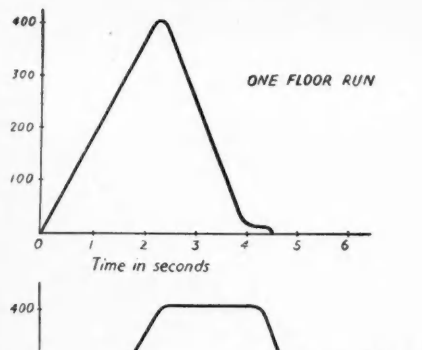




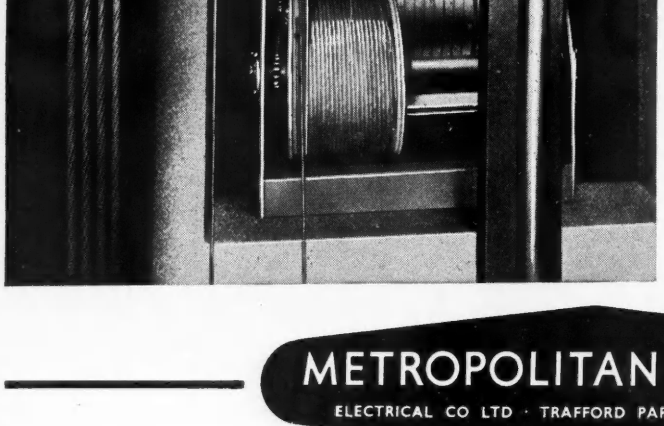




*The main lift controller and electronic control equipment, which can be sited in any convenient position.* Right · *Factual speed/time curves for this electronically controlled lift.* Below · *Drum mechanism, embodying cams and followers of the control gear, photographed across the lift shaft.*

# METROVICK ELECTRONIC CONTROL

## STEPLESS VARIABLE-VOLTAGE LIFT DRIVE



Faster operation, more accurate levelling, with increased passenger comfort, are among the advantages of the new M-V electronically controlled lift drive. For the first time, this system enables a lift to operate in accordance with its position in the well irrespective of direction of travel or load in the cage. Maximum lift speed can be attained even between adjacent floors. Write for full details.

**METROPOLITAN-VICKERS**

ELECTRICAL CO LTD · TRAFFORD PARK · MANCHESTER, 17

*Member of the AEI group of companies*

JJC304

electrical accumulators, batteries, acids and containers, dynamos, motors, transformers, magnetos and all electrical plant, etc. Directors: B. Alston and L. C. Harman. Regd. office: 104, Gt. Russell Street, W.C.1.

**L. Whittaker & Co. (Electrical Engineers), Ltd.**—Registered 6th October. Capital £1,000. To acquire the business of electrical engineers and contractors carried on by L. Whittaker and M. O. Whittaker, trading as L. Whittaker & Co., at 6, Danesway, Prestwich, Lancs. Directors: L. Whittaker, Myrtle O. Whittaker and M. J. Whittaker. Regd. office: 6, Danesway, Prestwich, Lancs.

**Roy Wilshere, Ltd.**—Registered 12th September. Capital £100. Manufacturers of and dealers in vacuum cleaners, suction plant, cleaning and sweeping tools, plant and machinery, etc. Directors: E. R. Wilshere and Kitty R. Wilshere. Regd. office: 39, Warren Avenue, Richmond, Surrey.

**Caledonia Domestic Appliances, Ltd.**—Registered in Edinburgh 26th August. Capital £1,000. Factors, distributors and manufacturers of vacuum cleaners, etc. Directors: J. Grew and Mrs. Joan Grew. Regd. office: 113, St. Vincent Street, Glasgow, C.2.

**Trade Installations, Ltd.**—Registered 22nd September. Capital £10,000. Designers, manufacturers, installers and repairers of and dealers in electrical, radio, sound recording, radio and television relay services, public and private amplifier and public address equipment, etc. Directors: L. W. Huggins and J. G. Sterry. Regd. office: 10, Parliament Street, Gloucester.

**Frank S. Polden & Co., Ltd.**—Registered 15th October. Capital £10,000. Factors of and dealers in electrical equipment, apparatus and appliances, etc. F. S. Polden signs as director. Regd. office: 24a and 24b, York Place, Leeds, 1.

## Increases of Capital

**Elliott Brothers (London), Ltd.**—Increased by £750,000, in 250,000 5½ per cent cumulative preference shares of £1 and 2,000,000 ordinary shares of 5s, beyond the registered capital of £750,000.

**M.K. Electric, Ltd.**—Increased by £1,200,000, in 800,000 ordinary and 400,000 preference shares of £1 each, beyond the registered capital of £300,000.

**Jackson Electric Stove Co., Ltd.**—Increased by £43,500, in £1 ordinary shares, beyond the registered capital of £53,500.

**Crofts Engineers (Holdings), Ltd.**—Increased by £1,000,000, in 5s ordinary shares, beyond the registered capital of £1,500,000.

**Lincass Electric, Ltd.**—Increased by £10,000, in £1 6 per cent cumulative redeemable preference shares, beyond the registered capital of £5,000.

**Sangamo Weston, Ltd.**—Increased by £275,000, in 10s ordinary shares, beyond the registered capital of £475,000.

**Duncan Watson (Electrical Engineers), Ltd.**—Increased by £50,000, in 5s ordinary shares, beyond the registered capital of £20,000.

**T. N. Robinson, Ltd.**—Increased by £20,000, in £1 ordinary shares, beyond the registered capital of £5,000.

**Whitehead Electrical Radio Co., Ltd.**—Increased by £49,000, in £1 shares, beyond the registered capital of £1,000.

**Kenwright Electrical Co., Ltd.**—Increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

**E. W. Jones (Electrical), Ltd.**—Increased by £19,000, in £1 shares, beyond the registered capital of £1,000.

## Bankruptcies

**W. J. Incledon,** lately trading at 203, West Derby Road, Liverpool, electrical engineer.—Receiving order made 25th October on debtor's own petition.

**W. Zack,** 111, Lordship Road, Stoke Newington, London, N.16, electrical contractor.—Public examination 29th November at Bankruptcy Buildings, Carey Street, London, W.C.2.

**K. M. Ashworth** and **D. Revell,** carrying on business in co-partnership as Ashworth & Revell, at 265, Bradford Road, Frizinghall, Bradford, and 120, Otley Road, Shipley.—Trustee, Mr. G. E. Rushton, 36, North Parade, Bradford, appointed 25th October.

**W. O. Curry,** 17, Kent Close, Bexhill-on-Sea, formerly carrying on business as an electrical contractor at 1, Tynevale Terrace, Lemington-on-Tyne, now electrician.—Public examination 13th December at the Town Hall, Hastings.

**A. C. Payne,** residing at 40, Springfield Road, Wickersley, Rotherham, steelworks electrician, formerly carrying on business at that address as electrical contractor. — Trustee, Mr. J. B. G. Moore, 55, Queen Street, Sheffield, Official Receiver, released 29th October.

## Liquidations

**Ace Electronics, Ltd.** (in voluntary liquidation).—Particulars of claims by 28th November to Mr. W. L. Norman, of B. Davis & Co., 59, Sloane Street, London, S.W.1, or to Mr. A. W. Hunter, of Latham & Co., Walter House, 418-422, Strand, London, W.C.2, joint liquidators.

**Dalmere Electronics, Ltd.** (in voluntary liquidation.—Meetings of members and creditors on 30th November at the offices of Joseph W. Shepherd & Co., 78, King Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. S. P. Heath.

**Duralectrics, Ltd.** — Winding up voluntarily. Liquidator, Mr. F. L. Moulding, 8, Paradise Square, Sheffield, appointed 1st October.

# CATALOGUES AND LISTS

**AUTOMOBILE EQUIPMENT.** — Illustrated 19-page catalogue describing the company's electrically-operated test equipment for the servicing of motor vehicles.—**Crypton Equipment, Ltd.,** Bridgwater, Somerset.

**CABLE TRUNKING.**—Descriptive folder giving particulars of "Smithlite" cable trunking and accessories.—**Herman Smith Smithlite, Ltd.,** Empire Works, Dudley, Worcs.

**FANS.** — 35-page catalogue (SF299) describing the company's "Sirocco" centrifugal fans and a leaflet (SF425) dealing with axial-flow fans for auxiliary mine ventilation. —**Davidson & Co., Ltd.,** Sirocco Engineering Works, Belfast.

**HEATING.**—Illustrated leaflet describing the "K-L" portable fan heater and ventilator. —**Key-Leather Co., Ltd.,** 5, Urswick Road, London, E.9.

**INSTALLATION MATERIALS.** — General priced catalogue of a range of electrical installation material.—**H. E. Kettle, Ltd.,** Knightrider Street, Maidstone, Kent.

**INSTRUMENTS.**—Illustrated catalogue (Section A) covering the company's range of miniature panel mounting instruments.—**Measuring Instruments (Pullin), Ltd.,** Electrin Works, Winchester Street, Acton, London, W.3.

**LIGHTING FITTINGS.**—44-page illustrated and priced catalogue of tungsten, fluorescent and discharge lighting fittings.—**Philips Electrical, Ltd.,** Century House, Shaftesbury Avenue, London, W.C.2.

Priced leaflet on the company's CF 60374 glass sided pendant fluorescent fitting.—**Cryselco, Ltd.,** Kempston Works, Bedford.

Brochure on single and multiple glass suspension fittings.—**Fredk. Thomas & Co., Ltd.,** Everton Buildings, Stanhope Street, London, N.W.1.

48-page illustrated, priced catalogue covering industrial, commercial and decorative fluorescent lighting fittings and eight priced leaflets dealing with new introductions to the company's range of general lighting fittings.—**Falk, Stadelmann & Co., Ltd.,** 91, Farringdon Road, London, E.C.1.

**TELEPHONE EQUIPMENT.** — 8-page decriptive bulletin dealing with the type 100 telephone meter.—**Automatic Telephone & Electric Co., Ltd.,** Strowger Works, Liverpool, 7.

**TRANSFORMERS.** — Loose-leaf binder containing a series of technical data sheets dealing with the company's standard range of transformers.—**Westool, Ltd.,** St. Helen's Auckland, Co. Durham.

**WATER HEATING.**—Price list (H.400-22), covering the company's range of domestic water heating equipment.—**Hotpoint Electric Appliance Co., Ltd.,** Peterborough.

**WELDING EQUIPMENT.**—Illustrated catalogues dealing with arc and resistance welding equipment. — **Metropolitan-Vickers Electrical Co., Ltd.,** Trafford Park, Manchester, 17.

**WIRING ACCESSORIES.** — 44-page priced catalogue covering the "Temco" range of switches, switch sockets and junction boxes, etc.—**T.M.C. Harwell (Sales), Ltd.,** 37, Upper Berkeley Street, London, W.1.

Priced 76-page catalogue dealing with the company's range of electrical accessories.—**M.K. Electric, Ltd.,** Wakefield Street, Edmonton, London, N.18.

# NEXT WEEK'S EVENTS

*Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged*

## Monday, 14th November

BIRMINGHAM. — Imperial Hotel, 6 p.m. I.E.E. South Midland Supply & Utilization Group. "Proving the Performance of Circuit-Breakers with particular reference to those of Large Breaking Capacity," by J. Christie, H. Leyburn and J. F. Bird, and "A New Testing Station for High-Power Circuit-Breakers," by J. Christie, H. Leyburn and R. W. Fenn.

BRISTOL. — Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Centre. "The Electrification of the Manchester-Sheffield-Wath Lines, Eastern and London Midland Regions, British Railways," by J. A. Broughall and K. J. Cook.

CHESTER.—Grosvenor Hotel, 7 p.m. I.E.E. Mersey & North Wales Centre. Annual dinner.

DERBY.—College of Art, Green Lane, 7 p.m. Institution of Production Engineers, North Midlands Region, Derby Section. "Automatic Inspection," by J. A. Sargrove.

IPSWICH.—Crown and Anchor Hotel, 6.30 p.m. I.E.E. East Anglian Sub-Centre. "Automatic Circuit Reclosers," by G. F. Peirson, A. H. Pollard and N. Care.

LEICESTER.—Demonstration Theatre, Electricity Offices, Charles Street, 6.45 for 7 p.m. Leicester Electrical Society. Members' evening.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. informal meeting. Discussion on "Is the Engineer Broad Enough in his Outlook?" opened by Dr. P. Dunsheath.

7, Victoria Street, S.W.1, 6.15 p.m. A.S.E.E. Central London Branch. "Electric Floor and Wall Warming."

Charing Cross Hotel, 11 a.m. Institute of Metal Finishing. Annual general meeting, followed at 3 p.m. by the presidential address: "Research and Industrial Application in Metal Finishing," by R. A. F. Hammond.

MALVERN.—Winter Gardens, 7.30 p.m. I.E.E. South Worcestershire Group. "Television Pick-up Tubes," by Prof. J. B. McGee.

NEWCASTLE-UPON-TYNE. — Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "A Transatlantic Telephone Cable," by Dr. M. J. Kelly, Sir Gordon Radley, G. W. Gilman and R. J. Halsey.

SHEFFIELD. — The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. "Interior Decoration and Lighting," by J. Wilson.

Livesey Clegg House, 7.30 p.m. Junior Institution of Engineers, Sheffield & District Section. President's address, "Railway Locomotive Engineering," by J. N. Compton.

WEMBLEY PARK. — Century Hotel, Forty Avenue, 8.15 p.m. A.S.E.E. North-West London Branch. "High Frequency Induction Heating."

## Tuesday, 15th November

ARBORFIELD.—Training Centre, Bailleul Barracks, 7 p.m. I.E.E. London Students' & Graduates' Section, district meeting. "An Introduction to the Transistor," by A. V. Bryant.

CHELTENHAM.—47, Promenade, 6.30 p.m. I.E.S. Gloucester & Cheltenham Centre. "Prescribing for Seeing," by M. L. Berson.

GLASGOW.—Grosvenor Restaurant, Gordon Street, 6 p.m. I.E.E. Scottish Centre. Dinner-dance.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement & Radio Sections. "An Electrolytic-Tank Equipment for the Determination of Electron Trajectories, Potential and Gradient" and "A Method of Tracing Electron Trajectories in Crossed Electric and Magnetic Fields," by D. L. Hollway. To be read by Dr. J. H. Westcott. (Joint meeting.)

Magnet House, Kingsway, 6.15 p.m. Institution of Engineers-in-Charge. "Fault Protection on Large Distribution Networks," by J. A. Fitzpatrick. (Joint meeting with the A.S.E.E.)

St. Ermin's Hotel, S.W.1, 7 for 7.30 p.m. Society of Engineers. Annual dinner.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Utilization Group. "Timing the Operation of Control Systems associated with Rotating Equipment," by C. Cuthbert and D. A. Picken and "The Dynamic Braking of Induction Motors," by Dr. D. Harrison.

PORTSMOUTH.—"Air Balloon," 598, Commercial Road, Mile End, 7.30 p.m. A.S.E.E. Portsmouth Branch. "Consumer Relationship," by W. B. Butler.

STONE.—Duncan Hall, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Maintenance Principles for Automatic Telephone Exchange Plant," by R. W. Palmer. (Joint meeting with the Stone-Stoke Centre of the Institution of Post Office Electrical Engineers.)

## Wednesday, 16th November

BRADFORD.—Lecture Hall, Church House, North Parade, 7 p.m. I.E.S. Leeds Centre. "Modelling with Light and Colour," by J. W. Howell.

CAMBRIDGE.—Dorothy Restaurant, Sydney Street, 7 for 7.30 p.m. I.E.E. East Anglian Sub-Centre. Annual dinner-dance.

LEEDS. — Hotel Metropole, 2.30 p.m. Institute of Fuel, Yorkshire Section. "Nuclear Power Stations."

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. Discussion on "Thermal Rating of Transformers," opened by R. A. Grierson.

I.E.E. London Students' & Graduates' Section. Visit to Associated Newspapers, Ltd., at 9.30 a.m.

Grosvenor House, W, 6.45 for 7.30 p.m. British Electrical & Allied Manufacturers' Association. Dinner.

Savoy Hotel, 12.30 for 1 p.m. Gauge & Tool Makers' Association. Informal luncheon, followed by annual general meeting.

MANCHESTER. — Engineers' Club, Albert Square, 2.30 p.m. Institute of Fuel, North-Western Section. "The Effect of Coal Quality on the Efficiency of a Shell Boiler Equipped with a Travelling-grate Stoker," by E. J. MacDonald and M. V. Murray. Preceded by members' luncheon (1 p.m.).

MIDDLESBROUGH. –Cleveland Scientific & Technical Institute, Corporation Road, 6.30 p.m. I.E.S. Tees-Side Group. "Contemporary Lighting," by K. S. Morris.

NEWCASTLE-UPON-TYNE. — King's College, 7 p.m. Society of Instrument Technology, Newcastle Section. "The Work of the Temperature Measurement Section of the N.P.L.," by J. A. Hall.

NOTTINGHAM. — E.M.E.B. Showroom Theatre, Smithy Row, 7.30 p.m. A.S.E.E. Nottingham Branch. American industrial films evening.

PORTSMOUTH.—College of Technology Extension, Anglesea Road, 6.30 p.m. I.E.E. Southern Centre. "Electrical Energy from the Wind," by E. W. Golding.

PRESTON.—19, Friargate, 7.15 p.m. A.S.E.E. Preston Branch. "Shop and Window Lighting," by R. L. C. Tate. (Joint meeting with I.E.S.)

REDDITCH.—College of Further Education, Easemore Road, 7.30 p.m. Institute of Industrial Supervisors. "Ultrasonics in Industry," by Dr. W. Summer.

SHEFFIELD.—Grand Hotel, 6.30 p.m. I.E.E. Sheffield Sub-Centre. "New Lamps, New Uses and New Lighting Techniques," by R. V. Mills.

Grand Hotel. Incorporated Plant Engineers, Sheffield & District Branch. Annual dinner.

## Wednesday, 16th November, and Thursday, 17th November

LONDON.—4, Grosvenor Gardens. Iron & Steel Institute. Autumn general meeting.

## Wednesday, 16th November, to Wednesday, 30th November

LONDON.—Olympia. Building Exhibition.

## Thursday, 17th November

CHELMSFORD.—Crompton's Social Hall, 7.30 p.m. Chelmsford Engineering Society. "The Toronto Subway," by G. J. Corson.

CHELTENHAM.—At the Cheltenham Motor Club, High Street, 7.45 p.m. Institution of Production Engineers, South Western Region, Gloucester Section. "The Practical Application of Production Engineering Research," by Dr. D. F. Galloway. (Joint meeting with Cheltenham District Branch of the British Horological Institute.)

DUBLIN.—Physical Laboratory, Trinity College, 6 p.m. I.E.E. Irish Branch. "Tools of Management," by E. R. Cox.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilization Section. "Timing the Operation of Control Systems Associated with Rotating Equipment," by C. Cuthbert and D. A. Picken, and "The Dynamic Braking of Induction Motors," by Dr. D. Harrison.

Burlington House, W, 4.30 p.m. Royal Society. Special general meeting, followed by "Physics at the Radar Research Establishment, Malvern," by R. A. Smith.

Caxton Hall, S.W.1, 2.30 p.m. Diesel Engineers' & Users' Association. "Failures of Diesel Engine Valve Springs with particular reference to Fatigue," by J. H. Darley.

MAIDSTONE.—Royal Star Hotel, 8 p.m. A.S.E.E. Kent Branch. Film show.

MANCHESTER.—N.W.E.B., Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Shop Window Lighting," by R. L. C. Tate.

SOUTHAMPTON. — Polygon Hotel, 8 p.m. A.S.E.E. Southampton Branch. Technical films.

WATFORD.—Clarendon Hotel, Station Road, 8.15 p.m. A.S.E.E. Watford Branch. "The Brewing Industry." (Also afternoon visit to a brewery.)

## Friday, 18th November

LEEDS.—Queen's Hotel, 7 for 7.30 p.m. I.E.E. North Midland Centre. Annual dinner.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, W.C.2. Society of Chemical Industry. Symposium on "The Protection of Cable-Sheathing against Corrosion."

Feathers Hotel, Broadway, S.W.1, 6 for 6.30 p.m. Electrical Trades' Commercial Travellers' Association. Dinner and annual general meeting.

Pepys House, 14, Rochester Row, 7 p.m. Junior Institution of Engineers. Chairman's address, "Automation—what are its Problems?" by A. S. Ladley.

Waldorf Hotel, 7 p.m. Institution of Works Managers. Annual general meeting.

MANCHESTER.—Grand Hotel. Incorporated Plant Engineers, Manchester Branch. Annual dinner.

NEWCASTLE-UPON-TYNE. — County Hotel. North East Electrical Club. Annual dinner.

SALTBURN.—Zetland Hotel, 7.30 p.m. I.E.E. Tees-Side Sub-Centre. Annual dinner and reunion.

SOUTHSEA.—South Parade Pier. E.I.B.A. Hants & Dorset Branch. Ball.

STONE.—Crown Hotel, 8.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dance.

## Saturday, 19th November

LONDON. — Waldorf Hotel. Incorporated Plant Engineers, London Branch. Annual dinner and dance.

OXFORD.—Y.M.C.A., 10, George Street, 6.30 p.m. A.S.E.E. Oxford, Reading & Districts Branch. "Modern Remote Control and Indication Techniques," by C. Gordon White.

# CONTRACT INFORMATION

## Accepted Tenders and Prospective Electrical Work

## CONTRACTS OPEN

*Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.*

**Australia.**—14th February. Snowy Mountains Hydro-Electric Authority, Sydney. 330 kV circuit-breakers, isolating switches, earthing switches, insulator stacks, current transformers, and voltage transformers. (E.S.B. 23828/55. Ten/16537.)*

18th January. State Electricity Commission of Queensland, Brisbane. 11,000 V metalclad switchgear. (E.S.B. 23465/55. Ten/16444.)*

**Belgium.**—23rd November. Regie des Telegraphes et des Telephones de Belgique, Brussels. Electric wire and cable. (E.S.B. 23115/55. Ten/16559.)*

**Bridlington.**—3rd December. Corporation. Plastic insulated and sheathed 660 V cable. (See this issue.)

**Egypt.**—5th December. Director General, Ports and Lighthouses Administration, Alexandria. V.h.f. radio telephone system for Alexandria Harbour. (E.S.B. 23955/55. Ten/16540.)*

**Esher.**—2nd December. U.D.C. Street lighting equipment. (See this issue.)

**Folkestone.**—Corporation. Street lighting equipment. (See this issue.)

**Formosa.**—Kiu Dah Pulp and Paper Mill, Taipei. Electric motors, ranging from 1 to 150 h.p. and six 200 kVA transformers. (E.S.B. 23494/55. Ten/16433.)*

1st December. Central Trust of China, Taipei. Mercury arc rectifiers, transformers, switchboards, etc. (E.S.B. 23619/55. Ten/16522.)*

**India.**—1st December. Commerce and Industries Department, Central Stores Purchase Section, Hyderabad-Deccan. Two 12,500 b.h.p. Kaplan turbines, two 10,000 kVA a.c. generators, two 10,000 kVA power transformers, indoor and outdoor switchgear, and all control equipment, including busbars and power control cables, etc., for the Tungabhadra Hydro-Electric Project No. 1. (E.S.B. 23573/55. Ten/16443.)*

**London.**—13th December. India Store Department. Recording blank discs. (See this issue.)

**Manchester.**—Firms wishing to be placed on an approved list for maintenance and decorative works at hospitals and clinics under the control of the South Manchester Hospital Management Committee should apply to the group supplies officer. (See this issue.)

**New Zealand.**—16th December. Director-General, Stores Division, G.P.O., Wellington. Power cable. (E.S.B. 23823/55. Ten/16530.)*

**Pakistan.**—5th December. Director General of Supply and Development, Chittagong. Nickel iron alkaline train lighting cells. (E.S.B. 23719/55. Ten/16480.)*

**Peterborough.**—21st November. City Council. Electrical installations in 42 houses. (See this issue.)

**Reading.**—28th November. Borough Council. Duplicate automatic electrically-driven centrifugal booster pumps, electric motors and auxiliary plant, for Emmer Green Station. Water engineer and manager, The Forbury.

**Rhodesia and Nyasaland.**—Federal Hydro-Electric Board. 330 kV switchgear and associated equipment for the Kariba hydro-electric scheme. (See this issue.)

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

**St. Albans.**—24th November. City Council. Street lighting for housing estate. (See this issue.)

**South Africa.**—24th November. Union Tender and Supplies Board, Pretoria. Six 15 kVA, 380/220 V self regulating lighting sets. (E.S.B. 23958/55. Ten/16518.)* 1st December. Voltage recorders. (E.S.B. 23957/55. Ten/16510.)* 8th December. Plugs and sockets for telephone connections.

28th November. Stores and Buying Branch, City of Johannesburg. Trolley vehicle overhead equipment. (E.S.B. 23518/55. Ten/16438.)*

2nd December. Durban Electricity Department. Single pole contactors. (E.S.B. 23461/55. Ten/16436.)* E.h.v. open type fuse cut-outs. (E.S.B. 23510/55. Ten/16455.)*

2nd December. Stores Department, South African Railways. Fault locators for cables and overhead lines. (E.S.B. 23866/55. Ten/16525.)* Telegraph line material. (E.S.B. 24015/55. Ten/16558.)* Train lighting batteries. (E.S.B. 23874/55. Ten/16516.)*

**Taunton.**—21st November. Borough Council. Electrical goods for one year from 1st January, 1956. L. Atwell, town clerk, Municipal Buildings.

## ORDERS PLACED

**Alsager.**—U.D.C. Sodium street lighting (£1,559).—Merseyside and North Wales Electricity Board.

**Carlisle.**—Housing Development Committee. Electrical installations for 214 houses, 22 bungalows and 16 flats at Morton (£6,293).—Hartley Electromotives.

**Dundee.**—Duncan of Jordanstone College of Art. Electrical work for the second development at Belmont, Perth Road, comprising the north wing and hall (£10,373).—Lowdon Bros. & Co. (Engineers).

**Newcastle-on-Tyne.** — City Council. Accepted. Overhead electric lines at Slatyford Lane transport depot (£3,327).—British Insulated Callender's Cables. Overhead line equipment (£1,404).—Alfred Wiseman & Co.

**Plymouth.**—City Council. Recommended. Improved lighting in the Museum (£6,545).—Madge & Son.

**Rowley Regis.**—Town Council. Installation of equipment required for six street lighting schemes (£11,502).—Revo Electric Co.

## WORK IN PROSPECT

*Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.*

**Barking.**—Works extensions; Wm. Warne & Co., Ltd., India Rubber Mills.

**Barnstaple.**—Offices and workshops, Pottington; R. Harris & Son, Ltd., Fair View, Westaway.

**Bath.**—Additional factory; Horstman, Ltd., James Street West.

Flats (94), with shops, Kingsmead area; H. Roberts, city architect.

**Bicester.**—Offices, Queen's Avenue, for Ploughley R.D.C.; J. W. Martin, surveyor, Waverley House, Bicester, Oxon.

**Birkenhead.**—Church hall for St. Mary's, Upton; A. Stanley Barnes, 7, Hamilton Square.

**Birmingham.**—Offices at the corner of Livery Street and Lionel Street, for Alfred Field & Co.; W. C. Skinner, Ltd., Birchfield Road, Perry Barr, Birmingham.

**Blackpool.**—Operating theatre unit at Victoria Hospital; J. & R. Fenton (Blackpool), Ltd., Caunce Street.

**Blandford.**—Police station (£36,000), for Dorset Standing Joint Committee; county architect, County Hall, Dorchester.

**Bolton.**—New premises at Manchester Road for Thomas & Evans, Ltd.; Smith & Allcock, Ltd., 471, Chester Road, Manchester, 16.

**Bournemouth.**—Group offices at Royal Victoria Hospital for South West Metropolitan Regional Hospital Board; Reynolds, Tonlins and Dexter, architects, Granville Chambers, Yelverton Road.

**Cardiff.**—Research station, Llanishen estate; Richard Thomas & Baldwins, Ltd., Ebbw Vale.

**Carlisle.**—New premises at Durranhill industrial estate for W. Gibson & Son; H. Barwick, Gilsland, Carlisle

**Coventry.**—Six unit factories at Fletchamstead Highway; city architect, Bull Yard.

**Cowley.**—Wholesale meat market in Marsh Road; Swift & Co., Ltd., meat importers, 58, West Smithfield, London, E.C.1.

**Croydon.**—Reconstruction of Windmill Road slipper baths and laundry; E. Taberner, town clerk, Town Hall.

**Cumberland.**—Building programme for 1956-57: Cleator Moor County Secondary School, Maryport Solway House School, South-East Carlisle County Secondary School and Workington Salterbeck County Secondary School; county architect, Portland Square, Carlisle.

**Darlington.**—Additions to St. Mary's R.C. Grammar School (£10,000); borough architect, Central Buildings.

Houses (34), Branksome estate; borough architect.

**Denham.**—Dwellings (26), Denham Green estate; Sir John Brown, A. E. Henson & Partners, architects, 117, Sloane Street, London, S.W.1.

**Exeter.**—Court house; city surveyor, 7, Southernhay West.

**Ellesmere Port.**—Houses (197), North Whitby estate; borough surveyor, Queen Street.

**Fakenham.**—Police station and court house (£22,000); Fisher & Sons, Ltd., builders, High Street.

**Gateshead.**—R.C. church and school, Leam Lane estate; Rev. B. A. Stronge, St. Patrick's Presbytery, Felling.

**Glastonbury.**—Sewage disposal works; A. E. Farr, Ltd., contractors, Station Road, Westbury.

**Grantham.**—Conversion of Stonebridge House into divisional police headquarters (£25,000); county architect, Sleaford, Lincs.

Alterations and extensions to Grantham Technical College (£120,000); county architect, Sleaford, Lincs.

**Great Yarmouth.**—Maternity unit for Gorleston Hospital; East Anglian Regional Hospital Board, 33, Parkside, Cambridge.

**Hatfield.**—Houses (30), Redhall estate north; J. H. Parker, R.D.C. architect, 82, Great North Road.

**Hebburn-on-Tyne.**—Further stage of Hebburn Technical College (£195,000); county architect, Court Lane, Durham.

**Hendon.**—Factory and offices, Edgware Road; Egerton Tool & Instrument Co., Ltd., Columbia Works, Edgware.

Factory, Brent Terrace; F. & C. Engineering Works, Pollard Road, London, N.W.9.

**Ilkeston.**—Dwellings (151), Vine Farm estate; borough surveyor.

**Kilkenny.**—New wing to St. Kiernan's College; Wm. H. Byrne & Son, architects, 20, Suffolk Street, Dublin.

**Luton.**—Final stage of Luton and South Bedfordshire College of Further Education (£412,500); Norman & Dawbarn, architects, 5, Gower Street, London, W.C.1.

**Manchester.**—Extensions to factory at Peel Lane, for Westmorland Clothing Co.; A. M. Isaacs, architect, 10, Corporation Street, Manchester.

**Mansfield.**—Church at the Ladybrook estate, for C. of E. Authorities; J. Searson, Ltd., Station Road, Sutton-in-Ashfield.

**Middlesbrough.** — New premises for Middlesbrough Little Theatre (£33,000); John McCreton, Ltd., builders, Kings Road, North Ormesby.

**Newcastle-on-Tyne.** — Factory additions, Back Chapman Street, for Metal Box Co., Ltd.; Cackett, Burns Dick and McKellar, architects, 21, Ellison Place.

Flats and maisonnettes in Hill Street and South Benwell Road and 69 houses at Kenton North; city architect, 18, Cloth Market.

Branch library, Sunbury Avenue; city architect.

Factory, Blandford Street, for E. Baker and Co., Ltd.; C. Solomon, architect, St. Mary's Place.

**Olney.**—Fire station, East Street; county architect, Buckingham.

**Oxford.**—Additional storey to works, Walton Well Road; W. Lucy and Co., Ltd., engineers, Eagle Ironworks.

Classroom wing and laboratories for Southfield School; city architect.

**Portadown.**—Fire station, Thomas Street; Northern Ireland Fire Authority, Castle Street, Lisburn.

**Prescot.**—Twin operating theatre at Whiston Hospital (£59,200), for Liverpool Regional Hospital Board; regional architect, 88, Church Street, Liverpool, 1.

**Preston.**—Houses and flats (115), Savick estate; borough surveyor, Municipal Buildings.

**Reading.**—Garage, workshops, Basingstoke Road; Reading Garage Co., Ltd., Cork Street.

**Rotherham.**—Extensions to technical college; A. F. Scott & Sons, architects, 23, Tombland, Norwich.

**Southampton.**—Two-storey ward block at Tatchbury Mount Hospital, Totton; architect to the South West Metropolitan Regional Hospital Board, 76, Wimpole Street, London, W.1.

**South Shields.**—Extensions to Town Hall (£90,000); borough engineer.

**Southwell.**—Houses (32), Ollerton and Edwinstowe, for R.D.C.; William Saunders & Partners, architects, 24, Castlegate, Newark-on-Trent.

**Sundon Park.**—Additional factory buildings; Skefko Ball Bearing Co., Ltd., Sundon Works.

**Surrey.**—Mixed school at Royal Hythe Farm, Egham (£185,212); J. Harrison, county architect, County Hall, Kingston-on-Thames.

**Sutton Coldfield.**—Houses (50), Rectory Road; H. Johnson, Ltd., 609a, Walsall Road, Perry Barr, Birmingham.

**Tatchbury.**—Two-storey ward block, Mount Hospital; Donald Rudd & Partners, consulting engineers, 24, Gloucester Place, London, W.1.

**Wakefield.**—Offices; Spencer Wire Co., Ltd., Denby Dale Road.

Works extensions; Calder Vale Glass Works, Ltd., Calder Vale Road.

**Walsall.**—Houses (48), Gipsy Lane estate; F. A. & H. Taylor, Croxtall Lane, Bloxwich.

**Walthamstow.**—Flats (52), Church Road and Wood Street; borough architect.

**Walton-on-Thames.**—Junior and infants' schools (£83,876); J. Harrison, county architect, County Hall, Kingston-on-Thames.

**Warwick.**—Extensions to county offices; Foster & Dicksee, Ltd., James Street, Rugby.

**Worcestershire.**—School building programme for 1956-57, including four new secondary schools and major extensions to three others (£1,002,100); R. Y. Logan, director of education, Castle Street, Worcester.

**York.**—Houses (80), Don Avenue and North Lane; F. Shepherd & Son, Ltd., builders, Blue Bridge Lane.

# NEW PATENTS

## Electrical Specifications Recently Published

*The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 0d each including postage) will be obtainable after 14th December from the Patent Office, 25, Southampton Buildings, London, W.C.2.*

**1948**

32293. Armstrong, E. H., Bose, J. H., and Hull, R. E.—Radio detection and ranging systems. 14th December, 1948. (741861.)

**1949**

13398. Le Tourneau, Inc., R. G.—Electrically controlled brake unit. 19th May, 1949. (741921.)

**1951**

10930. Soc. d'Etude de Matériel Automatique et de Controle, and Romanet, R. G. P.—Electrical instruments for measuring resistance. 9th May, 1951. (741862.)

19116. International Business Machines Corporation.—Circuit arrangement including a gaseous-discharge tube of the glow transfer type. 14th August, 1951. (741985.)

**1952**

4014. Lincoln Electric Co.—Electric arc welding. 14th February, 1952. (741989.)

7835/7. Walsall Conduits, Ltd.—Dolly-operated electric switches. 24th, 25th and 27th March, 1953. (741924/6.)

9658. Okolicsanyi, F.—Colour television apparatus. 13th April, 1953. (741929.)

12732. British Insulated Callender's Cables, Ltd.—Device for soldering pins, sockets and the like to the ends of wires and the like. 19th May, 1953. (741813.)

14118. Silvercrown, Ltd.—Electrodeposition of alloys containing copper and tin. 28th April, 1953. (741864.)

14497. Sylvania Electric Products, Inc.—Electroluminescent materials. 9th June, 1952. (741931.)

15638. Midgley, A. H.—Electric hot-wire relay or interruption devices. 18th June, 1953. (741933.)

21592. South Wales Switchgear, Ltd., Buttrey, R. N., and Mather, A. G.—High voltage circuit-breakers. 27th July, 1953. (741936.)

24849. Standard Telephones & Cables, Ltd.—Selective signalling equipment incorporating synchronized distributors. 3rd October, 1952. (741938.)

26642. Metropolitan-Vickers Electrical Co., Ltd.—Control arrangements for alternating current induction motors. 30th September, 1953. (741999.)

26646. Express Lift Co., Ltd., and Yeomans, K. A.—Electric timing apparatus. 23rd October, 1953. (741939.)

26671. Marconi's Wireless Telegraph Co., Ltd.—Frequency stabilizers and monitors. 19th October, 1953. (741867.)

32305. Siemens & Halske Akt.-Ges.—Teleprinter and like machines. 19th December, 1952. (741874.)

32422. Compagnie Générale de Travaux d'Eclairage et de Force, Anciens Etablissements Clemancon.—Colour-selector devices for colour lighting installations. 22nd December, 1952. (741944.)

**1953**

373. Ferranti, Ltd., O'Neil, S. R., King, P. G. R., and Buckingham, J.—Electron emitters. 11th March, 1954. (741945.)

567. Ferranti, Ltd.—Ion suppression in cathode-ray apparatus. 7th January, 1954. (741946.)

970. Dunlop Rubber Co., Ltd.—Electrically conductive polyvinyl resins. 22nd December, 1953. (741738.)

2239. Elliott Bros. (London), Ltd.—Apparatus for calibrating electric wire-wound resistance elements. 17th March, 1954. (741878.)

3814. National Research Development Corporation.—Electronic digital computers. 29th January, 1954. (741950.)

4559. General Electric Co., Ltd., and Pearson, E. J. B.—Electrically-heated warming plates. 18th February, 1954. (741880.)

5183. Truvox, Ltd. — Floor-drying machines. 25th January, 1954. (742002.)

7128. National Research Development Corporation.—Electrical gate circuits. 5th March, 1954. (741883.)

10434. General Electric Co., Ltd., and Friedlander, E. S.—Electric motor control systems. 14th April, 1954. (741841.)

10435. General Electric Co., Ltd., Friedlander, E. S., and Maer, C. A.—Control systems for electric motors. 14th April, 1954. (741955.)

10952. Radio-Industrie.—Television pick-up equipments and the like. 21st April, 1953. (742009.)

11696. Westinghouse Electric International Co.—Unitary thermally insulating members. 28th April, 1953. (742011.)

13736. Elliott Bros. (London), Ltd.—Means for indicating or recording the extent of rotation of an element. 16th August, 1954. (741889.)

15726. General Electric Co.—Electrical contact brushes. 8th June, 1953. (742018.)

16163. Kelvin & Hughes, Ltd.—Aerial arrays. 26th May, 1954. (741894.)

16785. Marconi's Wireless Telegraph Co., Ltd.—Directional aerial systems. 28th April, 1954. (741897.)

17105. Engineering & Lighting Equipment Co., Ltd., and Houghton, H. G.—Junction boxes for electrical wiring systems. 3rd June, 1954. (741771.)

19479. Standard Telephones & Cables, Ltd.—Wiring supports for electrical equipment. 9th July, 1954. (742021.)

20114. Soc. Technique pour l'Industrie Nouvelle Soc. Anon. Stin.—Electro-magnetic supervisory relays. 20th July, 1953. (742022.)

23292. Philips Electrical Industries, Ltd.—Circuits for two or more gas-filled or vapour-filled electric-discharge tubes. 24th August, 1953. (741966.)

23464. Belling & Lee, Ltd.—Directive aerials. 25th August, 1954. (741779.)

23852. General Electric Co., Ltd., and Patterson, K. G.—Apparatus for making high frequency electric tests. 30th August, 1954. (741907.)

24542. Standard Telephones & Cables, Ltd.—Electric filters employing gas-discharge tubes. 4th September, 1953. (742030.)

26188. Trevelyans (Birmingham), Ltd.—Electric lampholder. 27th August, 1954. (741908.)

29357. Belling & Lee, Ltd.—Aerials. 25th October, 1954. (741911.)

29677. Telefonaktiebolaget L. M. Ericsson.—Devices for demodulating high-frequency signals. 27th October, 1953. (741782.)

30314. Telefunken Ges., formerly Telefunken Ges. für Drahtlose Telegraphie.—Additive mixing circuits. 3rd November, 1953. (741913.)

30616. Philips Electrical Industries, Ltd.—Apparatus for X-ray spectrometry. 5th November, 1953. (741854.)

31953. Matthews & Yates, Ltd.—Fans. 21st July, 1954. (741975.)

32999. Philips Electrical Industries, Ltd.—Circuits for producing a variable high direct voltage. 27th November, 1953. (741787.)

34139. Stensholms Fabriks Aktiebolag.—Electric energy regulators. 8th December, 1953. (741789.)